

#### OPTIONAL DETERMINATION OF NON-SIGNIFICANCE (DNS) NOTICE MATERIALS

The attached materials are being sent to you pursuant to the requirements for the Optional DNS Process (WAC 197-11-355). A DNS on the attached proposal is likely. This may be the only opportunity to comment on environmental impacts of the proposal. Mitigation measures from standard codes will apply. Project review may require mitigation regardless of whether an EIS is prepared. A copy of the subsequent threshold determination for this proposal may be obtained upon request.

File No.

Project Name/Address:

Planner:

#### **Minimum Comment Period:**

Materials included in this Notice:

Blue Bulletin Checklist Vicinity Map Plans Other:

#### OTHERS TO RECEIVE THIS DOCUMENT:

State Department of Fish and Wildlife State Department of Ecology, Shoreline Planner N.W. Region Army Corps of Engineers Attorney General Muckleshoot Indian Tribe



# SEPA Environmental Checklist

The City of Bellevue uses this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

#### **Instructions**

The checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully and to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions.

You may respond with "Not Applicable" or "Does Not Apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies and reports. Please make complete and accurate answers to these questions to the best of your ability in order to avoid delays. For assistance, see <a href="SEPA Checklist Guidance">SEPA Checklist Guidance</a> on the Washington State Department of Ecology website.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The city may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

## **Background**

1.	Name of proposed project, if applicable	
2.	Name of applicant	
3.	Contact person	Phone
4.	Contact person address	
5.	Date this checklist was prepared	
6.	Agency requesting the checklist	

7.	Proposed timing or schedule (including phasing, if applicable)
8.	Do you have any plans for future additions, expansion or further activity related to or connected with this proposal? If yes, explain.
	Re-location of existing WCF monopole and associated equipment area at grade.
9.	List any environmental information you know about that has been prepared or will be
	prepared, that is directly related to this proposal.
10.	Do you know whether applications are pending for governmental approvals of other
	proposals directly affecting the property covered by your proposal? If yes, explain.
11.	List any government approvals or permits that will be needed for your proposal, if known.

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12	. Give a brief, complete description of your proposal, including the proposed uses and the
	size of the project and site. There are several questions later in this checklist that ask you to
	describe certain aspects of your proposal. You do not need to repeat those answers on this
	page. (Lead agencies may modify this form to include additional specific information on
	project description.) the combination of 2 existing parcels into i project limit on a 9.29 acre site for the construction of
12	. Location of the proposal. Give sufficient information for a person to understand the precise
13	location of your proposed project, including a street address, if any, and the section,
	township and range, if known. If a proposal would occur over a range of area, provide the
	range or boundaries of the site(s). Provide a legal description, site plan, vicinity map and
	topographic map, if reasonably available. While you should submit any plans required by
	the agency, you are not required to duplicate maps or detailed plans submitted with any
	permit applications related to this checklist.
Envi	ronmental Elements
LIIVI	Tommental Elements
Earth	
1.	General description of the site:
	□ Flat
	□ Rolling
	□ Hilly
	□ Steep Slopes
	□ Mountainous
	□ Other
2.	
۷.	what is the steepest slope on the site (approximate percent slope):

3.	What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.		
4.	Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.		
	No, there are no prior reports or surface indications of unstable soils on or in the immediate vicinity of the site. A liquefaction analysis was performed by Giles Engineering Associates as part of their geotechnical investigation and it was determined that the on-site soils are not subject to liquefaction during seismic activity. This was confirmed in the Hart Crowser Steep Slope Land Use Report.		
5.	Describe the purpose, type, total area and approximate quantities and total affected area of any filling, excavation and grading proposed. Indicate the source of the fill.		
6.	Could erosion occur as a result of clearing, construction or use? If so, generally describe.		
	Erosion Control per Clearing and Grading inspection and BCC 23.76.		
7.	About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?		

8.	Proposed measures to reduce or control erosion, or other impacts to the earth, if any.
	Erosion Control per Clearing and Grading inspection and BCC 23.76.
Air	
	What types of emissions to the air would result from the proposal during construction,
1.	operation and maintenance when the project is completed? If any, generally describe and
	give approximate quantities if known.
	give approximate quantities if known.
	Construction dust supresion measures per BCC 23.76.
2.	Are there any off-site sources of emissions or odor that may affect your proposal? If so,
	generally describe.
3.	Proposed measures to reduce or control emissions or other impacts to air, if any.
	Toposospacas co anno anno anno anno anno anno anno a

## Water 1. S

Su a.	rface Water Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
b.	Will the project require any work over, in or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
c.	Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of the fill material.
d.	Will the proposal require surface water withdrawals or diversions? Give a general description, purpose and approximate quantities, if known.
e.	Does the proposal lie within a 100-year floodplain?
	If so, note the location on the site plan.

	f.	Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
2.	Gr	ound Water
		Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.
	b.	Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

3.	Wa	ater Runoff (including stormwater)
	a.	Describe the source of runoff (including storm water) and method of collection and
		disposal, if any (include quantities, if known). Where will this water flow? Will this water
		flow into other waters? If so, describe.
	b.	Could waste materials enter ground or surface waters? If so, generally describe.
	c.	Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site?
	С.	If so, describe.
		in so, describe.
	Inc	licate any proposed measures to reduce or control surface, ground and runoff water,
		d drainage pattern impacts, if any.

Per Utilities Code 24.06 Storm and Surface Water

## **Plants**

1.	Check the types of vegetation found on the site:
	□ deciduous tree: alder, maple, aspen, other
	□ evergreen tree: fir, cedar, pine, other
	□ shrubs
	□ grass
	□ pasture
	□ crop or grain
	□ orchards, vineyards or other permanent crops
	□ wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
	□ water plants: water lily eelgrass, milfoil, other
	□ other types of vegetation
2.	What kind and amount of vegetation will be removed or altered?
3.	List any threatened and endangered species known to be on or near the site.
4.	Proposed landscaping, use of native plants or other measures to preserve or enhance
	vegetation on the site, if any.
	Per Utilities Code 24.06 Storm and Surface Water

5.	List all floxious weeds and invasive species known to be on or flear the site.
Anim	-1-
	List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include:
	Birds: □hawk, □heron, □eagle, □songbirds, □other
	Mammals: □deer, □bear, □elk, □beaver, □other
	Fish: □bass, □salmon, □trout, □herring, □shellfish, □other
2.	List any threatened and endangered species known to be on or near the site.
3.	Is the site part of a migration route? If so, explain.
4.	Proposed measures to preserve or enhance wildlife, if any.

5.	List any invasive animal species known to be on or near the site.
nerg	gy and Natural Resources
1.	What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating,
	manufacturing, etc.
ว	Mould your project affect the notablial use of solar aperguby adjacent properties? If so
2.	Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
	generally describe.
3.	What kinds of energy conservation features are included in the plans of this proposal? List
٥.	other proposed measures to reduce or control energy impacts, if any.
	other proposed mediates to reduce or control energy impacts, it arry.

## **Environmental Health**

fire	Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill or hazardous waste, that could occur as a result of this proposal? If so, describe.		
a.	Describe any known or possible contamination at the site from present or past uses.		
b.	Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.		
c.	Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.		
	a.		

	d.	Describe special emergency services that might be required.
	e.	Proposed measures to reduce or control environmental health hazards, if any.
		Clear and Grade Code BCC 23.76.
		Department of Ecology (DOE) Chapters in WAC.
2.	No	
	a.	What types of noise exist in the area which may affect your project (for example: traffic,
		equipment, operation, other)?
	h	What types and levels of noise would be created by or associated with the project on a
	υ.	short-term or a long-term basis (for example: traffic, construction, operation, other)?
		Indicate what hours noise would come from the site.
		Noise Control per BCC 9.18.
	c.	Proposed measures to reduce or control noise impacts, if any.
		Conditions of Approval to use noise supresion techniques throughout construction.

## **Land and Shoreline Uses**

1.	What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.
2.	Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to non-farm or non-forest use?
	a. Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling and harvesting? If so, how?
3.	Describe any structures on the site.

4.	Will any structures be demolished? If so, what?
<del>.</del>	What is the current zoning classification of the site?
5.	What is the current comprehensive plan designation of the site?
7.	If applicable, what is the current shoreline master program designation of the site?
3.	Has any part of the site been classified as a critical area by the city or county? If so, specify.
9.	Approximately how many people would reside or work in the completed project?
	Approximately how many people would the completed project displace?
	Proposed measures to avoid or reduce displacement impacts, if any.
12.	Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any.
	Master Development Plan, Design Review and Critical Areas Land Use Permit review.

13	. Proposed measures to ensure the proposal is compatible with nearby agricultural and
	forest lands of long-term commercial significance, if any.
Housi	ing.
	Approximately how many units would be provided, if any? Indicate whether high, middle,
1.	or low-income housing.
	or low-income nousing.
2	Approximately how many units, if any, would be eliminated? Indicate whether high, middle,
۷.	or low-income housing.
	or low-income nousing.
3.	Proposed measures to reduce or control housing impacts, if any.
٥.	Proposed measures to reduce or control mousing impacts, if any.
Aesth	netics
	What is the tallest height of any proposed structure(s), not including antennas; what is the
	principal exterior building material(s) proposed?
	principal enterior canality propessal.
	Building height is measured from average elevation of finished grade.
2.	What views in the immediate vicinity would be altered or obstructed?
	The Land Use Code does not protect views

3.	Proposed measures to reduce or control aesthetic impacts, if any
Light	and Glare
1.	What type of light or glare will the proposal produce? What time of day would it mainly
	occur?
2.	Could light or glare from the finished project be a safety hazard or interfere with views?
_	
3.	What existing off-site sources of light or glare may affect your proposal?
4.	Proposed measures to reduce or control light and glare impacts, if any.
٦.	roposed medsures to reduce or control light and glare impacts, if any.
	Land Has Cade 20 00 500 Links and place
	Land Use Code 20.20.522 Light and glare.
Recre	ation
1.	What designated and informal recreational opportunities are in the immediate vicinity?
2.	Would the proposed project displace any existing recreational uses? If so, describe.

3.	Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any.
Histo	ric and Cultural Preservation
1.	Are there any buildings, structures or sites located on or near the site that are over 45 years old listed in or eligible for listing in national, state or local preservation registers located on or near the site? If so, specifically describe.
2.	Are there any landmarks, features or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
3.	Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

4.	to resources. Please include plans for the above and any permits that may be required.
Trans	sportation
1.	Identify public streets and highways serving the site or affected geographic area and
	describe proposed access to the existing street system. Show on site plans, if any.
2.	Is the site or affected geographic area currently served by public transit? If so, generally
	describe. If not, what is the approximate distance to the nearest transit stop?
_	
3.	
	have? How many would the project or proposal eliminate?
4.	Will the proposal require any new or improvements to existing roads, streets, pedestrian,
	bicycle or state transportation facilities, not including driveways? If so, generally describe
	(indicate whether public or private).

5.	Will the project or proposal use (or occur in the immediate vicinity of) water, rail or air transportation? If so, generally describe.
6.	How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and non-passenger vehicles). What data or transportation models were used to make these estimates?
7.	Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.
8.	Proposed measures to reduce or control transportation impacts, if any.

## **Public Service**

1.	Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.
2.	Proposed measures to reduce or control direct impacts on public services, if any.
Utilit	ies
1.	Check the utilities currently available at the site:
	□ Electricity
	□ natural gas
	□ water
	□ refuse service
	□ telephone
	□ sanitary sewer
	□ septic system
	□ other
2.	Describe the utilities that are proposed for the project, the utility providing the service and the general construction activities on the site or in the immediate vicinity which might be needed.

## **Signature**

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature
Name of signee
Position and Agency/Organization
Date Submitted



## Non-project Action SEPA Checklist

## Supplement to Environmental Checklist

These questions pertain to land use actions that do not involve building and construction projects, but rather pertain to policy changes, such as code amendments and rezone actions.

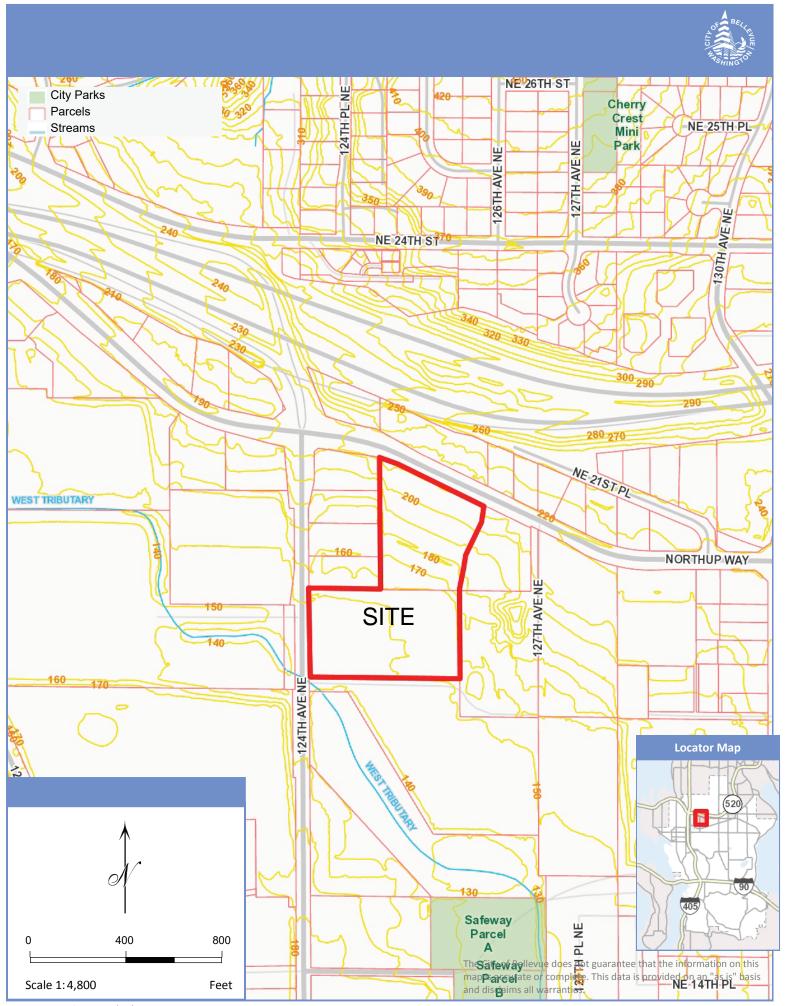
Because the questions are very general, it may be helpful to read them in conjunction with the Environmental Checklist. When answering these questions, be aware of the extent to which the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented.

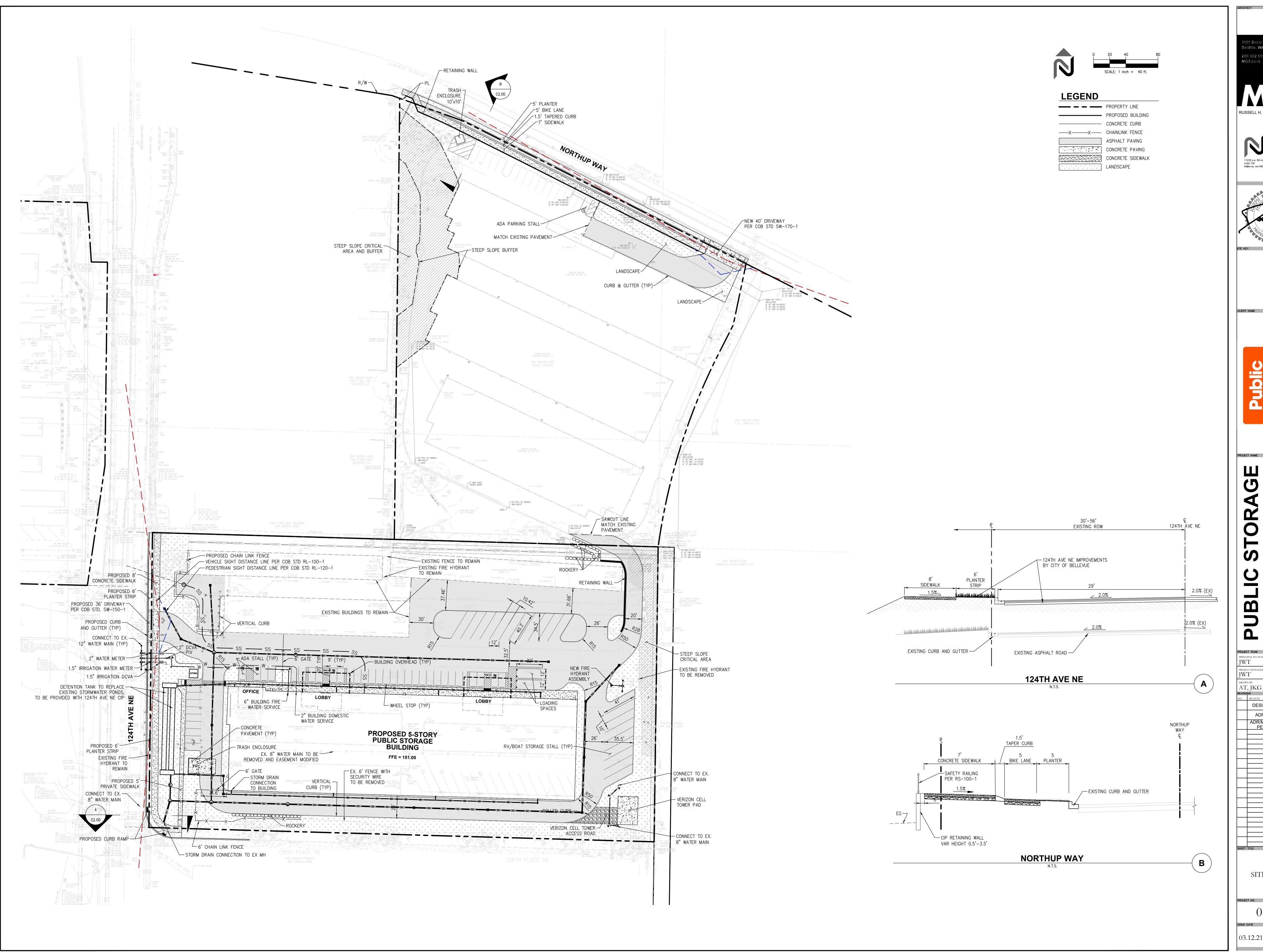
Respond briefly and in general terms.

	How would the proposal be likely to increase discharge to water; emissions to air; production
	storage, or release of toxic or hazardous substances; or production of noise?
	Indicate proposed measures to avoid or reduce such increases.
•	How would the proposal be likely to affect plants, animals, fish or marine life?

 	ndicate proposed measures to protect or conserve plants, animals, fish or marine life.
1	How would the proposal be likely to deplete energy or natural resources?
I	ndicate proposed measures to protect or conserve energy and natural resources.
L	
	How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wildern wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains or prime farmlands?
	vedarias, nodapianis or prime farmianas.
	ndicate proposed measures to protect such resources or to avoid or reduce impacts.
ŀ	How would the proposal be likely to affect land and shoreline use, including whether it wo
ć	allow or encourage land or shoreline uses incompatible with existing plans?
ć	

	Indicate proposed measures to avoid or reduce shoreline and land use impacts.
5.	How would the proposal be likely to increase demands on transportation or public services and utilities?
	Indicate proposed measures to reduce or respond to such demand(s).
7.	Identify, if possible, whether the proposal may conflict with local, state, or federal laws or
	requirements for the protection of the environment.

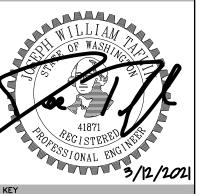




SITE | CIVIL

11235 s.e. 6th street
suite 150
bellevue, wa 98004

SITE | CIVIL
t: 425.453.9501
f: 425.453.8208
www.navixeng.com



DESIGN REVIEW

ADR/MDP SET ADR/MDP & CALUP PERMIT SET

SITE PLAN B

08193

ISSUE DATE SHEET NUMBER 03.12.21









Geotechnical Engineering Design Study

Public Storage Steep Slope Land Use Bellevue, Washington

**Prepared for**Public Storage

December 9, 2020 19577-00





## A division of Haley & Aldrich

Geotechnical Engineering Design Study

# Public Storage Steep Slope Land Use Bellevue, Washington

**Prepared for** 

Public Storage

December 9, 2020 19577-00

### **Prepared by**

Hart Crowser, a division of Haley & Aldrich

Lauren Phillips, EIT

Senior Staff, Geotechnical Engineer

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Lorne Arnold, PhD, PE

Associate, Geotechnical Engineer

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12/9/2020

**Douglas D. Lindquist, PE, LEED AP** Principal, Geotechnical Engineer

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- 2 Site Plan
- 3 Generalized Subsurface Cross Section A-A'
- 4 Fill Rockery Detail Full Length Reinforcement

#### APPENDIX A

**Field Exploration Methods and Analysis** 

#### **APPENDIX B**

**Laboratory Testing Program** 

#### APPENDIX C

**Historical Geotechnical Explorations by Others** 

#### APPENDIX D

**Slope Stability Analysis Report** 

#### **ATTACHMENT 1**

Navix Site Plan - Proposed Roadway



Geotechnical Engineering Design Study

## Public Storage Steep Slope Land Use Bellevue, Washington

#### INTRODUCTION

This report presents our geotechnical engineering design study for the Public Storage Connector Road project in Bellevue, Washington (Figure 1). This report supports the Critical Area Land Use Permit for the project. It presents our geotechnical engineering design recommendations and is organized as follows:

- Introduction
- Project Understanding
- Purpose, Scope, and Use of This Study
- Subsurface Conditions
- Seismic Considerations
- Geotechnical Engineering Design Recommendations
- Critical Areas Land Use
- Recommendations for Continuing Geotechnical Services

Tables are presented in the text and figures follow the text to illustrate the project area, exploration locations, and geotechnical design recommendations. Appendix A presents field exploration logs. Appendix B presents the laboratory test methods and results for the current study. Appendix C presents a historical exploration log in the project vicinity completed by others. Appendix D presents detailed input and results of our slope stability evaluation. Attachment 1 from Navix Engineering illustrates the proposed roadway geometry.

#### PROJECT UNDERSTANDING

The project site is located at 12465 Northup Way and 1800 124th Avenue NE in Bellevue, Washington. The connector road is planned to connect the northeast corner of the 124th Avenue parcel with the southeast corner of the Northup Way parcel. The properties currently contain several single-story storage buildings and paved ground-level parking. Based on the available survey data, the site in the vicinity of the proposed connector road slopes from north to south with grades ranging from an elevation of 172 to 153 feet North American Vertical Datum of 1988 (NAVD 88).

The new road will connect the southeast corner of the Northup Way parcel and the northeast corner of the 124th Avenue parcel, between the existing slope and the existing storage buildings. The project will require minimal cut and significant fill on the east side of the property as existing grade on the 124th Avenue parcel includes a raised road to connect the properties. One or more retaining wall(s) on the north and east sides of the existing building in the northeast corner will support the fill that makes up the base of the road. One of the existing storage buildings on the 124th Avenue parcel will be demolished to accommodate the new roadway. The existing slope between the two properties will be made less steep



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with a uniformly graded slope between the proposed road and the northernmost building on the 124th Avenue parcel.

A 54-inch-diameter sanitary sewer runs east-west between the Northup Way and 124th Avenue parcels. The utility is more than 25 feet below existing ground surface. The roadway will pass over the sewer, but minimal excavation is expected during construction and no disturbance to the utility is expected. Future access to the utility is taken into account in the roadway design.

There are two properties to the east of the proposed connector road that are owned by others. The northern of the two properties slopes from north to south and contains a two-story building and paved ground-level parking. The southern of the two properties is located at 1723 127th Avenue NE. It is mostly paved and slopes from north to south. The property is home to a composting and topsoil supplier and has stockpiles, ecology blocks, and heavy equipment around the site. Between this property and the 124th Avenue Parcel is a vegetated slope which is considered a steep slope critical area by the City of Bellevue. The connector road will run along a portion of this slope, from north to south, and the adjacent property will need to be considered for the slope stability analysis. In the footprint of the proposed roadway, the slope between these two properties will be made less steep.

Our understanding of this project is based on information provided by and discussions with Bellevue Public Storage and Navix Engineering as well as our experience in the area. Our understanding of the site and subsurface conditions is based on our work to date at the site and on multiple sites nearby, as well as the geotechnical report from Giles Engineering Associates, Inc. from 2018.

#### PURPOSE, SCOPE, AND USE OF THIS STUDY

The purpose of our work was to assess subsurface information and provide geotechnical engineering recommendations for design of the proposed connector road. If the proposed design of the road changes significantly we should be notified to revisit our recommendations. Our scope of work included:

- Reviewing existing subsurface information on the project site
- Completing one subsurface soil boring exploration
- Performing laboratory tests on soil samples obtained from the boring
- Providing geotechnical engineering recommendations for slope stability, earth retention, seismic considerations, critical areas land use permitting and other considerations
- Preparing this geotechnical engineering design report

This report is for the exclusive use of Public Storage and their design consultants for specific application to this project and site. This report was prepared in accordance with our contract dated September 9, 2020 and executed October 6, 2020. We completed this study in accordance with generally accepted geotechnical practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. We make no other warranty, express or implied.



#### SUBSURFACE CONDITIONS

Our interpretation of the subsurface conditions is based on conditions encountered in our boring as well as our review of historical geotechnical data near the site, our previous experience in the area, and published regional geologic maps. Hart Crowser, a division of Haley & Aldrich, completed one boring (HC-1) drilled to a depth of 30 feet on October 21, 2020. We also completed a shallow pothole on the slope between the 124th Avenue parcel and the adjacent property to the east. Finally, we reviewed historical borings completed on the 124th Avenue parcel (Giles Engineering Associates, Inc. 2018). The locations of our boring and a boring drilled and observed by others are shown on Figure 2.

Soil and groundwater conditions are summarized in the following sections. The conditions encountered in our explorations are presented in the boring log in Appendix A. The results of moisture content tests are presented at their respective depths in the boring log. The grain size analysis results for selected samples are presented in Appendix B. Boring logs in the nearby areas considered generally relevant for the project site are included in Appendix C.

Please note that the explorations referenced in this study reveal subsurface conditions only at discrete locations across the project site and that the actual conditions in other areas will vary. Furthermore, the nature and extent of any such variations would not become evident until additional explorations are performed or until construction activities are underway. If significant variations are observed at that time, we may need to modify our conclusions and recommendations accordingly to reflect actual site conditions.

#### Soil Conditions

In general, the subsurface soil consists of very dense glacially overconsolidated soils from the ground surface. These glacial soils are suitable for the foundation support. The soil layers observed during the field explorations program were broadly categorized based on their engineering properties, as shown below. In general, the soils observed in the explorations consist of the following soil units, described in the order they were encountered from the ground surface down.

### Weathered Till – Very Dense Sand and Sandy Silt

Borings indicate between 0 and 7 feet of very dense weathered till consisting of sand and sandy silt. The weathered till is a suitable unit for foundation support.

## Glacial Till – Very Dense Silty Sand and Silty Gravel with Sand

Below the weathered till, the borings indicated very dense, moist to wet, silty sand and gravel. This unit is a glacially overconsolidated glacial till material and appears to extend down to an elevation of at least 132 feet, based on nearby borings. The borings in this study terminated in this unit. Glacial till is a suitable unit for foundation support.

#### **Groundwater Conditions**

Our understanding of groundwater conditions at the site is based on observations during our explorations and conditions described in existing historical borings around the site (Figure 2 and Appendices A and C).



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Static groundwater was observed in Boring HC-1 at 13 feet below ground surface (bgs; elevation 157 feet) while drilling and at 10 feet bgs (elevation 160 feet) after drilling. In Historical Boring B-4 in the northeast corner of the 124th Avenue parcel, water was recorded at 12.5 feet bgs (elevation 141.5 feet). Both borings were drilled in the fall (October and November) and groundwater likely fluctuates. Fluctuations in groundwater conditions, including depth and volume, may be caused by variations in rainfall, temperature, season, and other factors.

Because the proposed access road involves minimal excavation, we do not anticipate that groundwater will be encountered during construction and a dewatering plan is unlikely to be necessary. If the proposed design changes significantly we should be notified to assess any impacts that groundwater may have.

#### SEISMIC CONSIDERATIONS

In this section, we describe the seismic setting at the project site, provide recommendations to develop the code-based design response spectrum, and discuss seismically induced geotechnical hazards.

### Seismic Setting

The seismicity of western Washington is dominated by the Cascadia Subduction Zone, in which the offshore Juan de Fuca Plate is subducting beneath the continental North American Plate. Three main types of earthquakes are typically associated with subduction zones: crustal, interface subduction, and intraslab subduction earthquakes.

Crustal Sources. Recent fault trenching and seismic records in the Puget Sound area clearly indicate a distinct shallow zone of crustal seismicity, the Seattle Fault, which may have surficial expressions and can extend 25 to 30 kilometers deep.

**Subduction Zone Sources.** The offshore Juan de Fuca Plate is subducting below the North American Plate. This causes two distinct types of events. Large-magnitude interface earthquakes occur at shallow depths near the Washington coast (e.g., the 1700 earthquake with a magnitude of 8 to 9) at the interface between the two plates. A deeper zone of seismicity is associated with bending the Juan de Fuca Plate below the Puget Sound region that produces intraslab earthquakes at depths of 40 to 70 kilometers (e.g., the 1949, 1965, and 2001 earthquakes).

## Design Response Spectrum

Here we provide code-based seismic design parameters for use on elements designed to American Society of Civil Engineers (ASCE) 7-16. ASCE 7-16 is referenced by the 2018 International Building Code (IBC), which we understand that the City of Bellevue will adopt February 1, 2021. The engineers should use the appropriate values based on the expected permit date.

The mapped response spectra are based on Site Class B (rock) conditions. Seismic parameters are adjusted according to the actual site conditions. The soil classification for this project location is Site Class C (very dense soil). IBC defines the design spectral acceleration parameters at short periods (SDS) and at the onesecond period ( $S_{1D}$ ) as two-thirds of the corresponding site-class-adjusted MCE<sub>R</sub> parameters ( $S_{MS}$  and  $S_{M1}$ ).



Similarly, ASCE 7 requires MCE<sub>G</sub> peak ground acceleration adjusted for site effects (PGA<sub>M</sub>) to be used for evaluation of liquefaction, lateral spreading, seismic settlements, and other soil-related issues. The resulting seismic design parameters are shown in Table 1.

Table 1 - ASCE 7-16 Seismic Parameters

Parameter	Value
Latitude	47.628
Longitude	-122.173
Site class	С
Risk category	I, II, or III
Peak ground acceleration, PGA	0.558 g
Spectral response acceleration at short periods, Ss	1.306 g
Spectral response acceleration at the 1-second period, S <sub>1</sub>	0.455 g
Seismic site coefficient, F <sub>PGA</sub>	1.2
Seismic site coefficient, Fa	1.2
Seismic site coefficient, F <sub>v</sub>	1.5
Peak ground acceleration adjusted for site class effects, PGA <sub>M</sub>	0.670 g

Notes: These and additional parameters may be obtained from: https://seismicmaps.org/

### Seismically Induced Geotechnical Hazards

Our assessment of the seismically induced geotechnical hazards at the project site is based on the existing soil explorations presented in this report, regional experience, and our knowledge of local seismicity. The potential hazards include surface rupture, liquefaction and subsidence, and lateral spreading.

Surface Rupture. The Seattle Fault Zone consists of multiple east-trending, north-verging reverse thrust faults located in the Puget Lowlands of western Washington. The northernmost splay of the Seattle Fault is estimated to be approximately 2.5 miles south of the site. Because there are not any known faults underlying the site, the hazard associated with surface rupture at the site during the life of the structure is considered low.

Landslides. The near surface soils are very dense and there is no evidence of previous slope instability. Furthermore, the proposed roadway will make the slope less steep. As described later in this report, our analysis indicates acceptable factors of safety for static and seismic slope stability. Therefore, the hazard associated with landslides is low.

Liquefaction and Subsistence. When cyclic loading occurs during a seismic event, the shaking can increase the pore pressure in loose to medium dense saturated sands and cause liquefaction, or temporary loss of soil strength. This can lead to surface settlement. We did not encounter saturated soil in a loose to medium dense condition in the borings conducted for this project. The soils below the groundwater table at this site are generally very dense silty sand and silty gravel with sand. The risk of liquefaction, seismically induced settlement, or significant ground deformation as a result of liquefaction from the design earthquakes is very low.



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Lateral Spreading. Lateral spreading is typically associated with lateral movement on sloping ground caused by liquefaction or a reduction of shear strength of soil within or under the slope. Lateral spreading could impact the proposed project by increasing the lateral force exerted on the structure supporting the roadway. However, because the liquefaction hazard is low, the lateral spreading hazard is also very low.

## GEOTECHNICAL ENGINEERING DESIGN RECOMMENDATIONS

This section of the report presents our geotechnical engineering analysis, conclusions, and design recommendations for the project. Our recommendations are based on our current understanding of the project and the subsurface conditions revealed by recent and historical borings. If the nature or location of the proposed roadway or retaining wall changes, Hart Crowser should be notified so that we can change or confirm our recommendations.

### Site Preparation and Grading

Site preparation for the proposed connector road will involve demolishing an existing building in the 127th Avenue parcel and removing trees and other vegetation on the existing slope. We recommend all site grading, paving, and any utility trenching be conducted during relatively dry weather.

It may be necessary to relocate or abandon some utilities. Excavation of these utility lines will probably occur through fill. Abandoned underground utilities should be removed or completely grouted. Ends of remaining abandoned utility lines should be sealed to prevent soil or water from entering the pipe. Soft or loose backfill should be removed and excavations should be backfilled with structural fill. Coordination with the utility agency is generally required.

A portion of the new road spans over a 54-inch-diameter sanitary sewer utility buried more than 25 feet bgs. The capacity of that utility to support the additional soil weight should be evaluated by the utility owner and/or civil engineer. We recommend that new fill be assumed to weigh 130 pounds per cubic foot in this analysis.

## Temporary Open Cuts

Based on the preliminary design, construction of the connector road appears to involve minimal cuts of the existing slope. However, it is important to keep in mind that the stability and safety of cut slopes depends on a number of factors, including:

- The type and density of the soil
- The presence and amount of any seepage
- Depth of cut
- Proximity of the cut to any surcharge loads near the top of the cut, such as stockpiled material, traffic loads, structures, etc., and the magnitude of these surcharges



- Duration of the open excavation
- Care and methods used by the contractor

The Occupational Safety and Health Administration classification of the site soils is Type C for fill soil and Type B for native glacial till above the water table. We make the following recommendations regarding open cuts for Type C soils.

- The maximum allowable slope for excavations less than 20 feet deep is 1.5H:1V for Type C and 1H:1V for Type B.
- Protect the slope from erosion by using plastic sheeting.
- Limit the maximum duration of the open excavation to the shortest time period possible.
- Place no surcharge loads (equipment, materials, etc.) within 10 feet of the top of the slope.

Because of the variables involved, actual slope angles required for stability in temporary cut areas can only be estimated prior to construction. We recommend that stability of the temporary slopes used for construction be the responsibility of the contractor, since the contractor is in control of the construction operation and is continuously at the site to observe the nature and condition of the subsurface. All excavations should be made in accordance with all local, state, and federal safety requirements.

## **Retaining Walls**

A retaining wall will support the new access road connecting the Northup parcel to the 124th Avenue parcel. We understand that several types of retaining walls are under consideration and that access to the sanitary sewer passing from east to west between the two parcels must be maintained. We provide recommendations for three possible retaining walls for the connector road, including rockery, mechanically stabilized earth (MSE), and cast-in-place/precast.

### **Rockery Retaining Walls**

A rockery with fill between it and the existing slope would be a suitable option for maintaining access to the sewer. The rockery must be engineered to meet City of Bellevue requirements because it is more than 4 feet high and fill soil will be behind it. The fill behind the rockery should be reinforced with fabric, however, the fabric will not be tied into the wall, so it is not considered an MSE wall. If it were necessary to access the sanitary sewer below, the rockery and fabric reinforcement could be disassembled and reconstructed. We make the following recommendations for the rockery and the reinforced fill behind the rockery:

- The rockery should be constructed as shown in Figure 4.
- The rockery should also be constructed in general accordance with the Federal Highway Administration (FHWA) rockery construction guidelines (FHWA 2006). A few key construction aspects are summarized below:
  - Base rock should be placed on a firm non-yielding subgrade.
  - Rocks should be placed so they interlock well with underlying rocks.



- Avoid continuous vertical joints between rocks in subsequent rows.
- Use chinking composed of angular quarry spalls or shot rock to fill voids behind/between large rockery rocks.
- Full length reinforcement fabric (Figure 4) is to be included in the fill behind the rockery were sufficient space exists.
- Where there is not sufficient space for reinforcement fabric, additional rockery rocks, larger rockery rocks, controlled density fill, angular quarry spalls, or other methods approved by Hart Crowser must be used to fill this space.
- The reinforcement fabric should be placed in general accordance with the FHWA MSE construction guidelines (FHWA 2009). A few key construction aspects are summarized below:
  - Reinforcement fabric should have a minimum long-term design strength of 1800 pounds per foot per American Society for Testing and Materials (ASTM) D-6637 or equivalent approved by the geotechnical engineer.
  - Use face forms to construct wrapped face reinforcement fabric to avoid loose geosynthetics that may lead to wall face deformation.
  - Stake the geosynthetic overlap layer to keep it taught during initial fill placement to reduce the potential for face deformation.
  - Place at least 3 inches of aggregate fill between the geosynthetic overlap layer and the layer above to avoid a slip plane created by geosynthetic layers in contact with each other.
- The fill should be as specified on Figure 4 to provide suitable drainage to the drain pipe. Additional drainage modifications would be needed if this material is not provided. Fill with less than 3 percent passing the U.S. No. 200 sieve (based on the minus 3/4-inch fraction) should be used around the perforated drainpipe, provided perforation size and aggregate size are compatible.
- We recommend that an experienced rockery contractor with at least 3 years of rockery construction experience, or 5 projects of similar scope and complexity, be selected to construct the rockery.

### Mechanically Stabilized Earth Walls

An MSE wall is another option to support the connector road, however, it does not provide the same flexibility as a rockery wall if access to the sanitary sewer is required. If an MSE wall is selected for use on this project, we recommend the MSE wall be designed by a specialty contractor pre-approved by the Washington State Department of Transportation (WSDOT) Geotechnical Design Manual (GDM) (WSDOT 2019). The MSE wall should be in general accordance with the GDM Section 15.5.3 and the American Association of State Highway and Transportation Officials Sections 11.5 and 11.0. MSE walls should be designed assuming a vertical traffic load of 250 pounds per square foot on the roadway.

## **Cantilever Gravity Walls**

Cantilever gravity walls may include precast, cast-in-place, or reinforced masonry wall systems. For cantilever gravity walls, the structural engineer can estimate the lateral load and resistance on the walls using an equivalent fluid to represent the soil. For typical granular fill soil, active and at-rest pressures may be determined using the equivalent fluid unit weights in Table . The equivalent fluid soil density does not



include any surface loading conditions or loading due to groundwater hydrostatic groundwater pressure; also, the ground surface behind the wall is assumed to be horizontal.

The use of active and passive pressure is appropriate if the wall is allowed to yield a minimum 0.001 times the wall height. For a non-yielding wall, at-rest pressures should be used.

Table 2 - Soil Equivalent Fluid Unit Weights for Walls Backfilled with Structural Fill

Soil Type	Earth Pressure	Value (pcf)
	Active	35
Structural fill	At-rest	55
	Passive <sup>a</sup>	300

#### Note:

The lateral earth pressures presented in Table are based on dewatered conditions so that hydrostatic pressure does not act on the walls. We make the following additional recommendations for walls with backfill material placed per structural fill recommendations:

- Sliding resistance to lateral loads is provided by passive soil resistance (as provided in Table 2) and by frictional sliding along the base of the footing. Use an allowable friction coefficient of 0.4 for footings with concrete poured directly on undisturbed native soil or well-compacted structural fill. Use an allowable friction coefficient of 0.3 for precast footings placed on undisturbed native soil or wellcompacted structural fill. The allowable friction coefficients include a factor of safety of 1.5; however, the passive earth pressure may require an additional reduction when used in conjunction with base friction. Greater displacements are required to mobilize full passive resistance than to mobilize full base friction resistance. Passive earth pressure mobilization should be calculated per Figure 8-6 of ASCE 41-17 and the lateral deflection calculated from this figure should be checked to determine if it is acceptable.
- The equivalent fluid pressure for passive resistance should be applied using triangular pressure distribution. Ignore the passive resistance in the upper 2 feet if the area surrounding the wall footing is unpaved. Apply a rectangular, horizontal traffic surcharge load of 75 pounds per square foot over the free height of the wall.
- Use a maximum allowable bearing pressure of 6 kips per square foot for design for footings placed on undisturbed native soils. Us a maximum allowable bearing pressure of 3 kips per square foot for footings placed on structural fill bearing on undisturbed native soils as described in the Structural Fill section of this report.
- We recommend a seismic surcharge 8H (where H is the total wall height) for cantilever gravity walls.



<sup>&</sup>lt;sup>a</sup> Includes a factor of safety of 1.5. See recommendations below.

### Permanent Drainage

The groundwater table sits below the proposed roadway and little to no excavation is expected during construction. However, rainfall and surface water should be accounted for in the retaining wall design. We recommend the following for permanent drainage behind any of the retaining wall options previously discussed:

- Install drains behind the wall face at the base of the wall. Drains, with cleanouts, should consist of a minimum 4-inch-diameter perforated pipe placed on a bed of, and surrounded by, 6 inches of freedraining material such as gravel backfill for drains per WSDOT Standard Specification 9-03.12(4) or a similar free-draining material with less than 3 percent passing the U.S. No. 200 mesh sieve based on minus 3/4-inch fraction. The drains should be sloped to carry the water to a sump or other suitable discharge.
- The drainage backfill should be continuous and envelop the drainage pipe behind the wall.

Additional drainage considerations for specific retaining wall types are provided in the following sections.

#### **Rockery Wall Drainage**

- Backfill immediately behind the wall with a 6-inch minimum zone of guarry spalls directly behind the rock face (see Figure 4).
- Fill in the fabric-reinforced zone behind the rockery should meet WSDOT standard spec 9-03.14(4) for gravel borrow for structural earth walls. This material provides relatively free-draining and will help prevent the buildup of hydrostatic pressures.

### Mechanically Stabilized Earth Wall Drainage

Earth fill for the MSE wall should meet WSDOT standard spec 9-03.14(4) for gravel borrow for structural earth walls. This material provides relatively free-draining and will help prevent the buildup of hydrostatic pressures.

## Cantilever Gravity Wall Drainage

- Backfill immediately behind the wall with a minimum thickness of 18 inches of well-graded, freedraining sand or sand and gravel.
- Cantilever gravity walls without adequate permanent drainage must be design for full hydrostatic pressure.

#### Structural Fill

Backfill placed below paved areas should be considered structural fill. The following sections include our recommendations for structural fill selection, placement, and compaction.



#### Reuse of Site Soil as Structural Fill

In general, explorations indicated that the site soils are likely not suitable for use as structural fill. The suitability of site soils for use as structural fill should be evaluated during construction. The suitability of excavated site soils for compacted structural fill depends on the gradation and moisture content of the soil when it is placed. As the amount of fines (that portion passing the No. 200 sieve) increases, the soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. Soil containing more than approximately 5 percent fines cannot be consistently compacted to a dense non-yielding condition when the water content is greater than approximately 2 percent above or below optimum. Reusable soil must also be free of organic and other deleterious material.

#### Selection of Import Fill

For import soil to be used as structural fill, we recommend using a non-silty, well graded sand or sand and gravel with less than 5 percent passing the U.S. No. 200 mesh sieve by dry weight (based on the minus 3/4-inch fraction) for import structural fill placed during wet weather periods. Compaction of material containing more than approximately 5 percent fine material may be difficult if the material is wet or becomes wet during rainy weather. During dry weather, import soil can contain fines up to 20 to 30 percent, provided it is compacted at a moisture content within 2 percent of the optimum moisture content. For the rockery and MSE wall we recommend gravel backfill that meets WSDOT standard spec 9-03.14(4) for gravel borrow for structural earth walls.

#### Placement and Compaction of Structural Fill

We make the following recommendations for the proposed structure:

- Before fill control can begin, the compaction characteristics or proposed fill material must be determined from representative samples of the structural and drainage fill. Samples should be obtained as soon as possible, but at least 3 days prior to use on site. A study of compaction characteristics should include determination of optimum and natural moisture contents and maximum dry density of these soils at the time of placement. Additionally, the grain size distribution of the fill should be determined.
- Structural fill can consist of either imported soil or recompacted selected on-site soil, if their moisture content is suitable and weather conditions allow.
- Compact structural fill to a minimum of 95 percent of the maximum dry density as determined by the modified Proctor (ASTM D 1557) test method, except within 2 feet horizontally of structural walls where the compaction requirement should be 92 percent.
- Maintain moisture content within 2 percent of the optimum moisture content (ASTM D 1557).
- Place structural fill only on dense, non-yielding subgrade soils.



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- Place and compact all structural fill in even lifts with a loose thickness no greater than 10 inches. If small, hand-operated compaction equipment is used to compact structural fill, fill lifts should not exceed 6 to 8 inches in loose thickness.
- In wet subgrade areas, clean material with a gravel content (material coarser than a U.S. No. 4 sieve) of at least 30 to 35 percent may be necessary.
- The compacted densities of all lifts should be verified by testing. Any material to be used as structural fill should be sampled and tested prior to use on site, to determine its maximum dry density and gradation.

## Slope Stability Analysis

A conceptual design for the connector road was provided by Navix Engineering via email on November 17, 2020. The connector road generally decreases the steepness of the existing slope; however, a slope stability analysis was conducted using the software Slide2 (Rocscience 2020) to assess the effects of the roadway construction.

A subsurface soil profile was developed based on the drilled boring at the top of the slope and a historical boring at the toe of the slope. The subsurface section is shown on Figure 3. The roadway dimensions are based on the conceptual design sent by Navix Engineering. A summary of the engineering soil units (ESU) and their properties used in the analysis are shown in Table 3.

Table 3 - Summary of ESU and Engineering Properties for Slope Stability Analysis

ESU	Description	Friction Angle (degree)	Cohesion (psf)	Unit Weight (pcf)
1	Very dense weathered till	39	0	135
2	Very dense glacial till	40	0	135
3	Structural fill imported for roadway	36	0	130

The slope profile analyzed in Slide2 passes diagonally from the northeast to southwest, through the southeast corner of the Northup Way parcel. At its steepest, the slope is approximately 2:1 (H:V). The factor of safety of the slope was determined for the current condition and with the roadway. In addition, a surcharge load of 250 pounds per square foot at the top of the slope, where the neighboring topsoil supplier is located, was also considered. Results for the static and seismic slope stability analyses are shown in Table 4 with detailed information in Appendix D. The factor of safety for slope stability is acceptable for all the static and seismic cases that were analyzed.



Table 4 - Summary of Factors of Safety for Slope Stability Analysis

	Model	Factor of Safety	Minimum Target Factor of Safety
Existing	Static	1.9	1.5
Condition	Pseudostatic	1.2	1.1
With Roadway	Static	2.7	1.5
	Static with surcharge	2.7	1.5
	Pseudostatic	1.5	1.1

Based on the results of our stability analysis, on site observations, and the proposed conceptual design, the connector road meets the performance objectives for risk against slope failure. By decreasing the steepness of the slope, the roadway actually improves the stability of the slope.

#### CRITICAL AREAS LAND USE

The City of Bellevue designates the slope between the Northup Way and 124th Avenue parcels as a steep slope critical area. The slope to the east of the 124th Avenue parcel bordering the composting and topsoil supplier is also considered a steep slope. Based on Section 20.25H.120 of the Bellevue Municipal Codes, steep slopes are those with a rise of at least 10 feet, a slope of 40 percent or more, and an area of at least 1,000 square feet. Based on available survey data for the Public Storage parcels, the slope height ranges from approximately 10 to 17 feet, at its steepest the slope is up to approximately 80 percent, and the area covers approximately 7,000 square feet.

The Bellevue Land Use Codes (LUC) address the performance standards relating to steep slope critical areas. The performance standards are listed and addressed individually below.

#### 20.25H.125 Performance Standards – Landslide hazards and steep slopes.

In addition to generally applicable performance standards set forth in LUC 20.25H.055 and 20.25H.065, development within a landslide hazard or steep slope critical area or the critical area buffers of such hazards shall incorporate the following additional performance standards in design of the development, as applicable. The requirement for long-term slope stability shall exclude designs that require regular and periodic maintenance to maintain their level of function.

A. Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography.

Response: The natural contour of the site slopes outside of the connector road footprint and will remain essentially unaltered. The construction of the roadway will leave the existing slope largely undisturbed as it involves building up the grade to meet the slope rather than removing material or cutting into the slope. Further, due to the flatness of the lower site, it is likely the existing slope was over steepened during historical grading.

B. Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation.



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Response: The location of the connector road has been set based on the programmatic function of the project. The natural steep slopes on the site have been kept with the exception of the area where the connector road will be constructed.

C. The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties.

Response: As part of the geotechnical study completed for the project, the stability of the slopes along the north and east side of the site have been modeled using slope stability software. The results of these numerical analyses indicate that by decreasing the steepness of the slope, the presence of the connector road increases the slope factor of safety.

D. The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes where graded slopes would result in increased disturbance as compared to use of retaining wall.

Response: The intent of the project is to use a retaining wall that allows for minimal disturbance to the existing natural slope.

E. Development shall be designed to minimize impervious surfaces within the critical area and critical area buffer.

Response: This is the case. With the exception of the roadway itself, the remainder of the site is intended to minimize impervious surfaces and a drainage system is included in the retaining wall design.

F. Where change in grade outside the building footprint is necessary, the site retention system should be stepped and regrading should be designed to minimize topographic modification. On slopes in excess of 40 percent, grading for yard area may be disallowed where inconsistent with this criteria.

Response: N/A – New buildings are not a part of the proposed project.

G. Building foundation walls shall be utilized as retaining walls rather than rockeries or retaining structures built separately and away from the building wherever feasible. Freestanding retaining devices are only permitted when they cannot be designed as structural elements of the building foundation.

Response: The existing buildings located near the proposed connector road have not been designed to act as retaining structures, therefore, a retaining wall is proposed to support the roadway. New buildings are not a part of the proposed project.

H. On slopes in excess of 40 percent, use of pole-type construction which conforms to the existing topography is required where feasible. If pole-type construction is not technically feasible, the structure must be tiered to conform to the existing topography and to minimize topographic modification.

Response: N/A – New buildings are not a part of the proposed project.

I. On slopes in excess of 40 percent, piled deck support structures are required where technically feasible for parking or garages over fill-based construction types.

Response: N/A – New buildings are not a part of the proposed project.



J. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. (Ord. 5680, 6-26-06, § 3).

Response: In our opinion, because the proposed development does not negatively impact the stability of steep slopes in this critical area, no special mitigation and restoration plans are required. Any temporary disturbance of the slope, if performed according the recommendations in this report, will not require additional mitigation.

The above information should be used for the project Critical Areas Report (CAR). The CAR should address all applicable items described in LUC 20.25H.

In our opinion, based on our analysis and review of project information, the proposed development meets the performance requirements outlined in LUC 20.25H.125.

# RECOMMENDATIONS FOR CONTINUING GEOTECHNICAL **SERVICES**

Recommendations discussed in this report should be reviewed and modified, if necessary, as project elements progress through final design. As part of final design, we recommend that Hart Crowser:

- Continue to meet with the design team as needed to address geotechnical questions that may arise as the design progresses.
- Review geotechnical aspects of the final design plans and earthwork specifications to see that our recommendations were properly interpreted and implemented in the design documents.

During the construction phase of the project, we recommend that Hart Crowser review contractor submittals and provide a representative to observe:

- Excavation and site grading
- Excavation and preparation of the subgrade for retaining wall
- Installation of retaining wall and drainage system
- Placement and testing of compacted material
- Other geotechnical engineering considerations that may arise during the course of construction.

The purpose of our observations is to verify compliance with geotechnical design concepts and recommendations and to allow design changes or evaluation of appropriate construction methods in the event that subsurface conditions differ from those anticipated prior to the start of construction.



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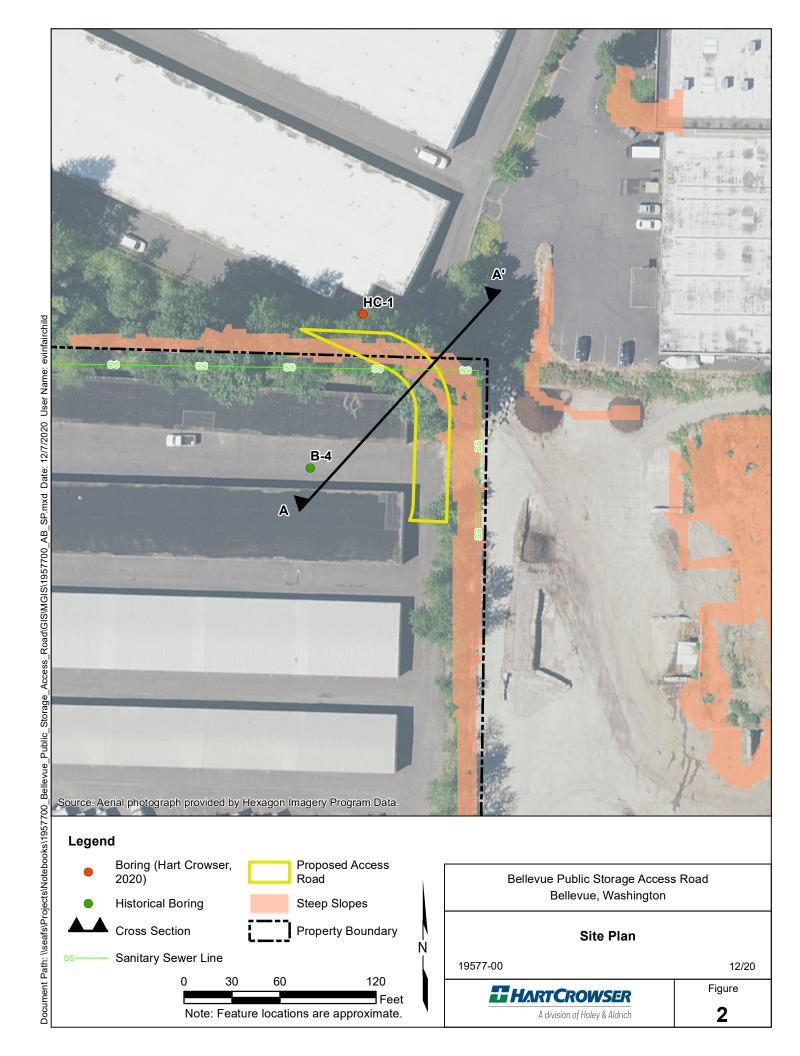
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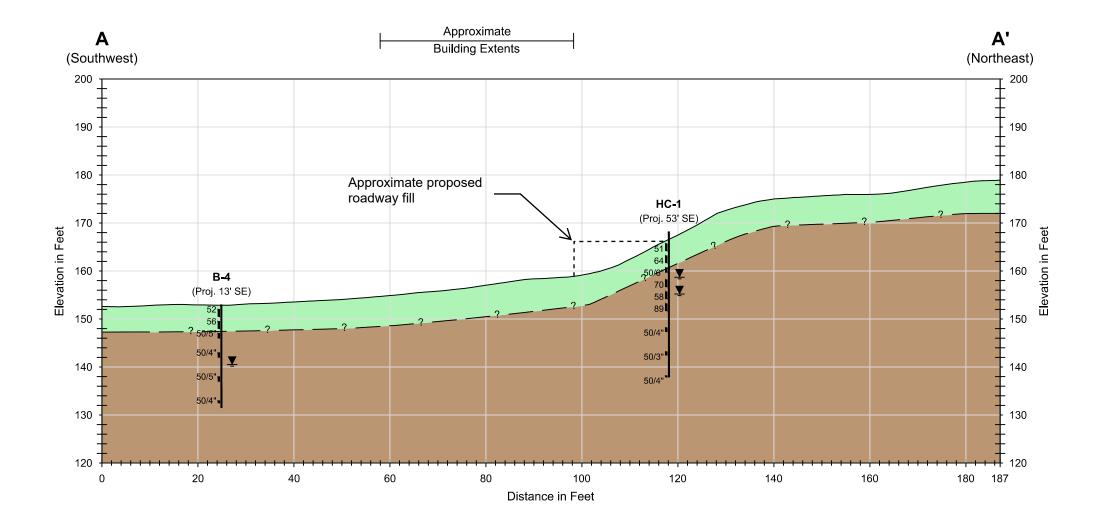
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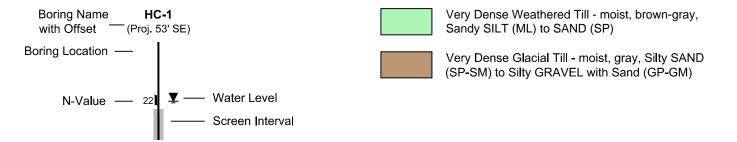












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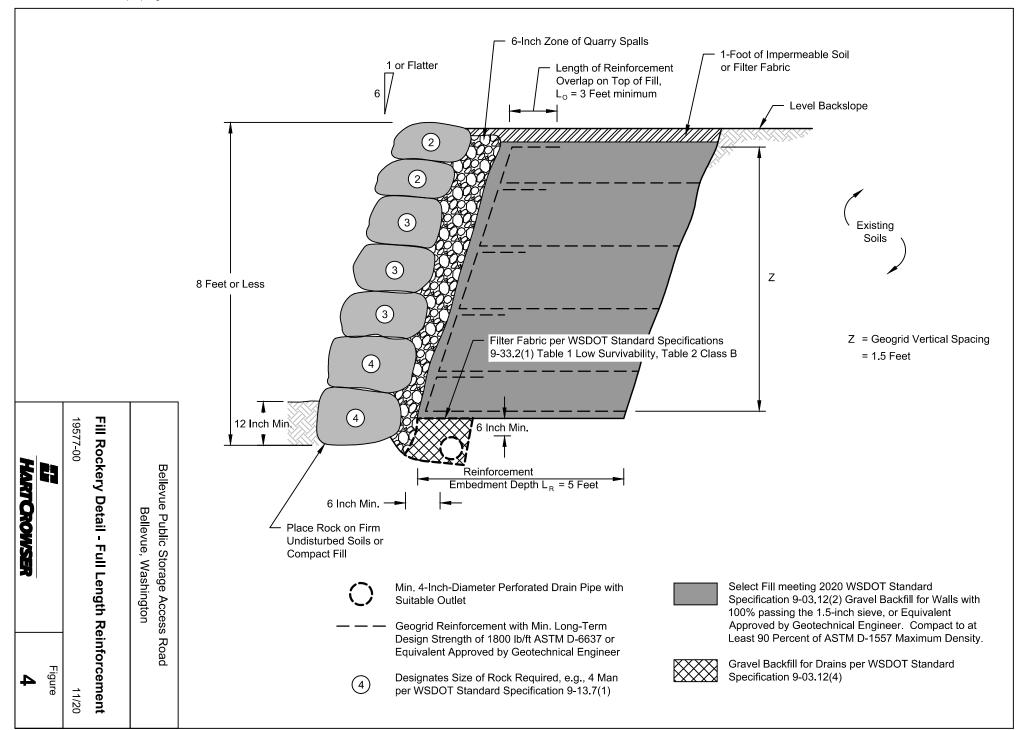
Generalized Subsurface Cross Section A-A'



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Figure **3** 

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# APPENDIX A Field Exploration Methods and Analysis



#### APPENDIX A

### Field Exploration Methods and Analysis

This appendix documents the processes Hart Crowser used to determine the nature of the soils underlying the project site. The discussion includes information on:

- Explorations and Their Location
- The Use of Hollow-Stem Auger (HSA) Borings
- Standard Penetration Test (SPT) Procedures

### **Explorations and Their Location**

Subsurface explorations for this project include one boring from the current project phase. The exploration log in this appendix shows our interpretation of the drilling, sampling, and testing data. The log indicates the interpreted depth where the soils change. Note that the change may be gradual. In the field, we classified the samples collected from the explorations according to the methods presented on Figure A-1 - Key to Exploration Logs. Figure A-1 also provides a legend explaining the symbols and abbreviations used in the logs.

**Location of Explorations.** Figure 2 shows the location of exploration located by hand measuring from existing features. The ground surface elevation at this location was interpreted from elevations obtained from a PDF file of the boundary and topographic survey performed by Lanktree Land Surveying, Inc. (dated September 25, 2017). The measuring method used determines the accuracy of the location and elevation of the explorations.

## The Use of Hollow-Stem Auger Borings

One HSA boring, designated HC-1, was completed on October 21, 2020. The boring was drilled to a depth of 30.3 feet using a 6-inch inside-diameter hollow-stem auger. The boring was advanced with a truck-mounted Diedrich D-50 drill rig subcontracted by Hart Crowser. The drilling was continuously observed by a geotechnical engineer from Hart Crowser. A detailed field log was prepared for the boring. Using the SPT, we obtained samples at 2.5-foot-depth intervals for the first 15 feet and at 5-foot-depth intervals after that.

The borings log is presented on Figure A-2 at the end of this appendix.

#### Standard Penetration Test Procedures

This test is an approximate measure of soil density and consistency. To be useful, the results must be used with engineering judgment in conjunction with other tests. The SPT (as described in ASTM D 1586) was used to obtain disturbed samples. This test employs a standard 2-inch outside-diameter split-spoon sampler. Using a 140-pound automatic hammer, free falling 30 inches, the sampler is driven into the soil for 18 inches. The number of blows required to drive the sampler the last 12 inches only is the Standard Penetration Resistance, or N-value. The N-value is an indication of the relative density of granular soils and



## A-2 | Public Storage Steep Slope Land Use

the consistency of cohesive soils. The N-values are plotted on the boring log at their respective sample depths.

Soil samples are recovered from the split-barrel sampler, field classified, and placed into watertight jars. They are then taken to Hart Crowser's laboratory for further testing.

#### In the Event of Hard Driving

Occasionally, very dense materials preclude driving the total 18-inch sample. When this happens, the N-value is determined as follows.

**Penetration less than 6 inches.** The N-value is the total number of blows over the number of inches of penetration.

Penetration greater than 6 inches. The N-value is the sum of the total number of blows completed after the first 6 inches of penetration over the number of inches driven that exceed the first 6 inches. The number of blows needed to drive the first 6 inches are not included in the N-value in this case. For example, the N-value for a blow count series of 12 blows for 6 inches, 30 blows for 6 inches, and 50 (the maximum number of blows counted within a 6-inch increment for SPT) for 3 inches would be 80/9.



#### **Relative Density/Consistency**

Soil density/consistency in borings is related primarily to the standard penetration resistance (N). Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on

SAND or GRAVEL Relative Density	N (Blows/Foot)	SILT or CLAY Consistency	N (Blows/Foot)
Very loose	0 to 4	Very soft	0 to 1
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Medium stiff	5 to 8
Dense	31 to 50	Stiff	9 to 15
Very dense	>50	Very stiff	16 to 30
-		Hard	>30

#### Moisture

-OGS (SOIL ONLY) - J. GINTHOL LIBRARY.GLB - 10/23/20 09:50 - "SEAFSIPROJECTS/NOTEBOOKS/1957700 BELLEVUE PUBLIC STORAGE ACCESS ROADIFIELD DATA/PERM GINT FILES/1957700-BL. GPJ -

Dry Moist Absence of moisture, dusty, dry to the touch

Damp but no visible water

Wet Visible free water, usually soil is below water table

#### USCS Soil Classification Chart (ASTM D 2487)

dan Diniala		Sym	bols	Typical		
ıjor Divisions		Graph	USCS	Descriptions		
	Clean		GW	Well-Graded Gravel; Well-Graded Gravel with Sand		
	(<5% fines)		GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand		
Gravel and			GW-GM	Well-Graded Gravel with Silt; Well-Graded Gravel with Silt and Sand		
Gravelly Soils	Gravels		GW-GC	Well-Graded Gravel with Clay; Well-Graded Gravel with Clay and Sand		
More than 50% of Coarse Fraction	(5-12% fines)		GP-GM	Poorly Graded Gravel with Silt; Poorly Graded Gravel with Silt and Sand		
Retained on No. 4 Sieve			GP-GC	Poorly Graded Gravel with Clay; Poorly Graded Gravel with Clay and Sand		
			GM	Silty Gravel; Silty Gravel with Sand		
	(>12% fines)		GC	Clayey Gravel; Clayey Gravel with Sand		
	Sands with		SW	Well-Graded Sand; Well-Graded Sand with Gravel		
	(<5% fines)		SP	Poorly Graded Sand; Poorly Graded Sand with Gravel		
Sand and	Sands (5-12% fines)		SW-SM	Well-Graded Sand with Silt Well-Graded Sand with Silt and Gravel		
Soils More than 50% of Coarse		• ///	SW-SC	Well-Graded Sand with Clay; Well-Graded Sand with Clay and Gravel		
			SP-SM	Poorly Graded Sand with Silt; Poorly Graded Sand with Silt and Gravel		
Passing No. 4 Sieve			SP-SC	Poorly Graded Sand with Clay; Poorly Graded Sand with Clay and Grave		
	Sands with		SM	Silty Sand; Silty Sand with Gravel		
	(>12% fines)		SC	Clayey Sand; Clayey Sand with Gravel		
Silts			ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt		
Oilte	•	Ш	МН	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt		
			CL-ML	Silty Clay; Silty Clay with Sand or Gravel Gravelly or Sandy Silty Clay		
Clave	e		CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay		
Clay	3		CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay		
Organ	ics		OL/OH	Organic Soil; Organic Soil with Sand or Gravel; Sandy or Gravelly Organic Soil		
Highly Organic (>50% organic material)				Peat - Decomposing Vegetation - Fibrous to Amorphous Texture		
	and Gravelly Soils  More than 50% of Coarse Fraction Retained on No. 4 Sieve  Sand and Sandy Soils  More than 50% of Coarse Fraction Passing No. 4 Sieve  Silts  Clay  Organ  Highly Organic	Gravel and Gravelly Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve  Gravels with Fines (>12% fines)  Sand with few Fines (<5% fines)  Sand Sand Sand Sandy Soils More than 50% of Coarse Fraction Passing No. 4 Sieve  Sands with few Fines (<12% fines)  Sands With Fines (512% fines)  Clays Gravels with Fines (512% fines)  Clays Organics  Gravels With Fines (512% fines)	Gravel and Gravels (<5% fines)  Gravel and Gravelly Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve  Sand and Sandy Soils More than 50% of Coarse Fraction Passing No. 4 Sieve  Sands with few Fines (<5% fines)  Sands with Fines (<5% fines)  Sands with Fines (<12% fines)  Clays  Clays  Organics	Gravel and Gravelly Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve  Sand and Sandy Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve  Gravels with Fines (-12% fines)  Sands with few Fines (-5% fines)  Sands with few Fines (-5% fines)  Sands with few Fines (-5% fines)  Sands Sands SW-SC  Sands with Fines (-5% fines)  Sands W-SC  Sands with Fines (-5% fines)  SP-SM  SP-SC  Sands with Fines (-12% fines)  CI-ML  Clays  CH  Organics  GW-GM  GW-GM  GW-GM  GW-GM  GW-GM  GW-GM  GW-GM  GP-GM  Fines  SP-SM  SW-SC  SP-SM  SP-SC  SANDS W-SC  SANDS W-SC  SANDS W-SC  SANDS W-SC  SP-SC  SANDS W-SC  SANDS W-SC  SP-SC  SANDS W-SC  SANDS W-SC  SP-SC  SANDS W-		

Minor Constituents	Estimated Percentage					
Sand, Gravel						
Trace	<5					
Few	5 - 15					
Cobbles, Boulders						
Trace	<5					
Few	5 - 10					
Little	15 - 25					
Some	30 - 45					

Soil Te %F AL	St Symbols  Percent Passing No. 200 Sieve  Atterberg Limits (%)  Liquid Limit (LL)  Water Content (WC)  Plastic Limit (PL)
CA CAUC CAUE CBR CIDC CIUC CKODC CKODC CKOUE CRSCN DS DT GS HYD ILCN KOCN kc kf MD OC OT P PID PP SG TRS TV UC UUC VS WC	Chemical Analysis Consolidated Anisotropic Undrained Compression Consolidated Anisotropic Undrained Extension California Bearing Ratio Consolidated Drained Isotropic Triaxial Compression Consolidated Drained Isotropic Triaxial Compression Consolidated Isotropic Undrained Compression Consolidated Ko Undrained Direct Simple Shear Consolidated ko Undrained Compression Consolidated ko Undrained Extension Constant Rate of Strain Consolidation Direct Simple Shear In Situ Density Grain Size Classification Hydrometer Incremental Load Consolidation ko Consolidation Constant Head Permeability Falling Head Permeability Moisture Density Relationship Organic Content Tests by Others Pressuremeter Photoionization Detector Reading Pocket Penetrometer Specific Gravity Torsional Ring Shear Torvane Unconfined Compression Unconsolidated Undrained Triaxial Compression Vane Shear Water Content (%)

#### **Groundwater Indicators**

 $\overline{\Delta}$ Groundwater Level on Date or At Time of Drilling (ATD)

Groundwater Level on Date Measured in Piezometer

Groundwater Seepage (Test Pits)

### Sample Symbols

1.5" I.D. Split Spoon

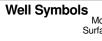
**T** 

Rock Core Run

3.25" O.D. Split Spoon Modified California Sampler

Sonic Core Thin-walled Sampler

Cuttings Push Probe



Monument Surface Seal Signal Cable Bentonite Seal Well Casing Vibrating Sand Pack Wire Piezometer Well Tip or Slotted Screen (VP) Slough

HARTCROWSER

Project: Bellevue Public Storage Access Road

Location: Bellevue, WA Project No.: 19577-00

Key to **Exploration Logs**  Figure **A-1** 1 of 1 Sheet

Logged by: L. Phillips Checked by: E. Capron Drilling Method: Location: Lat: 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Ground Surface Elevation: 168.1958 feet (NAVD 88) Hammer Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Mammer Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: Lat. 47.627808 Long: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Type: -122.172722 (WA State Plane N, NAD 83, ft.) Rig Model/Ty								Checked by: E. Capron 2722 (WA State Plane N, NAD 83, ft.) st (NAVD 88)	Drilling Method: Hollow Stem Auger Rig Model/Type: Diedrich D-50 / Track- Hammer Type: Auto-hammer Hammer Weight (pounds): 140	r Type: Diedrich D-50 / Track-mounted drill rig r Type: Auto-hammer r Weight (pounds): 140							
Elevation (feet)	O Depth (feet)	1 - 1   1-1   1   0							laterial scription				¥ Fine ▲ S	WC (%	) ent (%) alue	10	Depth (feet)
165	- - -	8 25 26		9ij.	8	S-1		↑ Asphalt (~2 inches).  POORLY GRADED SAND (SP), tr brown. [WEATHERED TILL]	ace gravel, very dense, dry to moist	/						5	1
1   091	5 <del></del> - -	7 30 34 23 50			8	S-2 S-3		With interbedded layers of gray, sil								64	
- - -	10	22 32 38		18in.	8 0	<u>S-4</u> GS, WC					ATD ATD ATD		•			49	- 10
155	15 — -	26 32 22 39 50		_	8 8	S-5 S-6 GS, WC		Becomes wet.  Becomes moist.			¥		•		38	58	- 1
150	20 —	29 50	X	ij 1	0	S-7		SILTY GRAVEL WITH SAND (GM	), very dense, moist, gray.							50/	- 2
145	- - 25 -	32 50	X	9in.	9	S-8 <u>S-9</u> 3S, WC		Approximate 6-inch seam of poorly	graded sand.				13			50/	- 2
140	30 —	50		<u>:i</u>		S-10		Pottom of Po	vahala at 20.2 faat							30/	-3
135	- - -	-						Bottom of Bot	ehole at 30.3 feet.							50/	4"
1. 2. 3. 4.	Mater USCS Grour	to Fig rial str desi ndwat	gure atun gnat er le	n lin ions vel,	es are if inc	re interpr based or dicated, is	etive n visu s at ti	descriptions and symbols. and actual changes may be gradual. Solid al-manual identification (ASTM D 2488), un me of drilling/excavation (ATD) or for date s as are approximate.	less otherwise supported by laboratory tes	lines in ting (AS	ndica STM	ate grad D 248	dual or a	approxi	mate co	ontacts.	

- Refer to Figure A-1 for explanation of descriptions and symbols.
   Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
- 3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
- 4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

Project No.: 19577-00

HART CROWSER A division of Haley & Aldrich

Bellevue Public Storage Access Road Project: Location: Bellevue, WA

Boring Log HC-1

**A-2** Figure 1 of 1 Sheet

# APPENDIX B Laboratory Testing Program



#### APPENDIX B

### **Laboratory Testing Program**

A laboratory testing program was performed for this study to evaluate the basic index and geotechnical engineering properties of the site soils. Disturbed soil samples were tested. The tests performed and the procedures followed are outlined below.

#### Soil Classification

**Field Observation and Laboratory Analysis.** Soil samples from the exploration were visually classified in the field and then taken to our laboratory where the classifications were verified in a relatively controlled laboratory environment. Field and laboratory observations include density/consistency, moisture condition, and grain size and plasticity estimates.

The classifications of selected samples were checked by laboratory tests such as grain size analysis. Classifications were made in general accordance with the Visual-Manual Procedure, ASTM D 2488, as presented on Figure B-1.

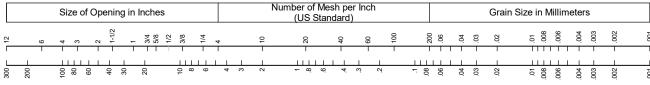
#### Water Content Determinations

Water contents were determined, for several samples recovered in the exploration, in general accordance with ASTM D 2216, as soon as possible following their arrival in our laboratory. Water contents were not determined for very small samples nor samples where large gravel contents would result in values considered unrepresentative. The results of water content tests are plotted at their respective sample depths on the exploration logs.

## Grain Size Analysis

Grain size distribution was analyzed on representative samples in general accordance with ASTM D 422. The results of the tests are presented as curves on Figure B-2 plotting percent finer by weight versus grain size.



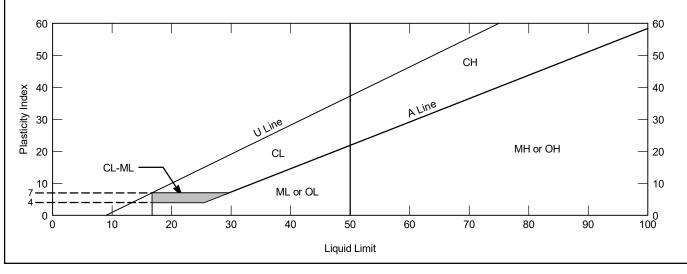


#### Grain Size in Millimeters



#### **Fine-Grained Soils**

Fine-Grained Soils > 50% smaller than No. 200 Sieve							
Soils	s with Liquid Limit <	50%	Soils	50%			
SILT	CLAY	ORGANIC	SILT	CLAY	ORGANIC	PEAT	
ML	CL	OL	МН	СН	ОН	PT	



#### **Coarse-Grained Soils**

TO GRAPH REPORTS - J.;DRAFTING/GINT/PORTLAND LIBRARY 031317/HC\_LIBRARY; GLB - 4/21/17 09:05 - L.;NOTEBOOKS/1928000\_ALDO PROJECT/FIELD DATA/PERM\_GINT FILES/1928000-EXPLORATIONS. GPJ

Coarse-Grained Soils > 50% Larger than No. 200 Sieve									
GRAVEL > 50% Coarse Fraction Larger than No. 4 Sieve					SAND > 50% Coarse Fraction Smaller than No. 4 Sieve				
GRAVEL with 5% Fines	G'	W	GP		SAND with 5% Fines	SW		SP	
GRAVEL with >12% Fines	GM		GC		SAND with > 12% Fines SM		SM		С
GRAVEL with 5% < Fines <12%	GW-GM	GW-GC	GP-GM	GP-GC	SAND with 5% < Fines <12%	SW-SM	SW-SC	SP-SM	SP-SC

For clean sands and gravels:

$$1 \leq \frac{(D_{30})^2}{D_{10} \ x \ D_{60}} \leq 3 \qquad \& \qquad \frac{D_{60}}{D_{10}} \quad \text{where} \qquad \begin{array}{c} > 4 \ \text{for GW} \\ > 6 \ \text{for SW} \end{array} \qquad \text{otherwise GP or SP} \qquad \qquad C_c = \frac{(D_{30})^2}{D_{10} \ x \ D_{60}}$$

 $D_{10}$ ,  $D_{30}$ ,  $D_{60}$  are particle diameters for which 10, 30, and 60 percent, respectively, of the soil mass are finer.

For sands and gravels with fines:

GM and SM Atterberg limits below A line with PI < 4

GC and SC Atterberg limits above A line with PI > 7

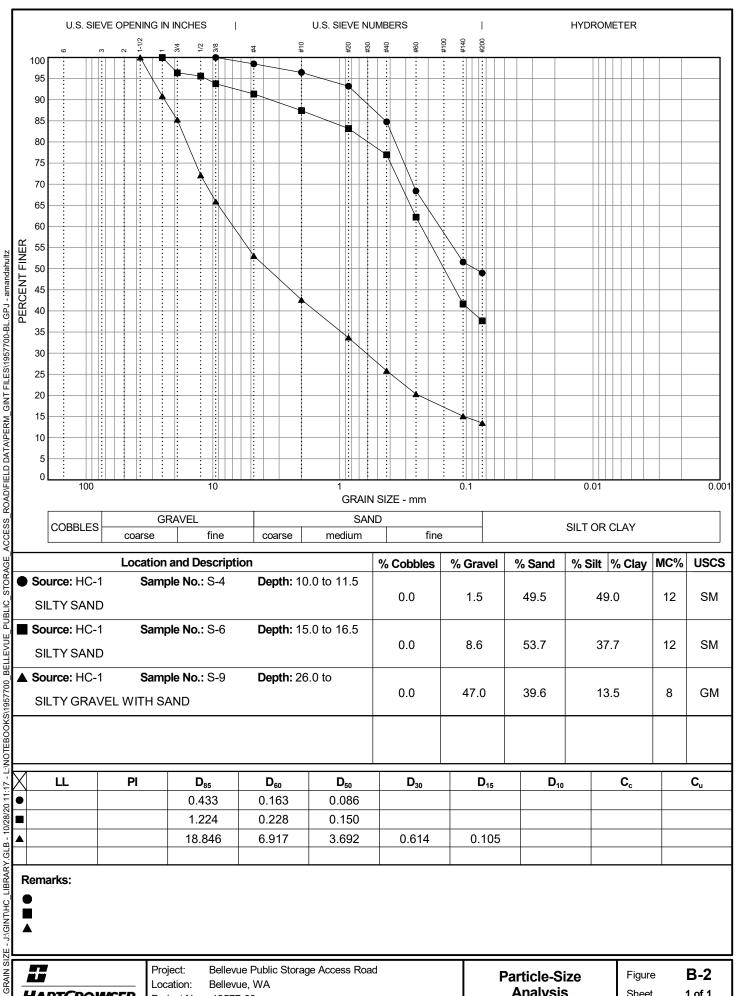
Project No.: 19577-00

<b>S</b>
<b>HARTCROWSER</b>

Project: Bellevue Public Storage Access Road Location: Bellevue, WA

Unified Soil Classification (USC) System

Figure **B-1**Sheet 1 of 1



	Location and Description	on	% Cobbles	% Gravel	% Sand	% Silt  % Clay	MC%	USCS
● Source: HC-1	Sample No.: S-4	<b>Depth:</b> 10.0 to 11.5						
SILTY SAND			0.0	1.5	49.5	49.0	12	SM
Source: HC-1	Sample No.: S-6	<b>Depth:</b> 15.0 to 16.5						
SILTY SAND			0.0	8.6	53.7	37.7	12	SM
▲ Source: HC-1	Sample No.: S-9	<b>Depth:</b> 26.0 to						
SILTY GRAVEL	WITH SAND		0.0	47.0	39.6	13.5	8	GM
	·							

17 - L		LL	PI	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
0.11:	•			0.433	0.163	0.086					
)/28/2				1.224	0.228	0.150					
'n	▲			18.846	6.917	3.692	0.614	0.105			
딩											

#### Remarks:

<b>HARTCROWSER</b>	

Project: Bellevue Public Storage Access Road

Location: Bellevue, WA Project No.: 19577-00

Particle-Size **Analysis** 

**B-2** Figure 1 of 1 Sheet

# APPENDIX C Historical Geotechnical Explorations by Others



#### APPENDIX C

# **Historical Boring Logs**

We have included the logs of subsurface explorations conducted on the 124th Avenue parcel in 2017 by Giles Engineering Associates, Inc. The log for boring 4 is included due to its proximity to the proposed connector road.

Logs performed by firms other than Hart Crowser are presented for reference only and Hart Crowser is not responsible for the accuracy or completeness of the information presented in the logs. Approximate locations of these borings are shown on Figure 2, and actual locations may differ from those shown.



# BORING NO. & LOCATION: SURFACE ELEVATION: 151 feet COMPLETION DATE: 11/30/17 FIELD REP: TREVOR SLAZAS

# **TEST BORING LOG**

PROPOSED PUBLIC STORAGE REDEVELOPMENT

1800 124TH AVENUE NE BELLEVUE, WA

**GILES ENGINEERING** ASSOCIATES, INC.

PROJECT NO: 2G-1710005

MATERIAL DESCRIPTION		Depth (ft)	Elevation	Sample No. & Type	N	Q, (tsf)	Q <sub>p</sub> (tsf)	Q, (tsf)	W (%)	PID	NOTES
Approximately 3 inches of asphaltic condover 2 inches of aggregate base			150	1-SS	14				8		
Gray Silty fine Sand, little Gravel - Moist (Possible Fill)				1-00	"				0		
Brown fine to coarse Sand, trace to little some Gravel - Very Moist to Wet (Possit Native)	Silt, ole	5-	-	2-CS	29				14		
Light Brown fine Sandy Silt - Very Moist Wet (Native)	to	-	— 145 —	3-CS	28				19		
		10-	140	4-SS	49				16		
		-									
Gray fine to coarse Sand with Gravel, tra ittle Silt, possible Cobbles and Boulders Moist	ce to	15 — - -	- 135 -	5-SS	50/1"				11		
		¥ -	-								~
		20 —	— 130 –	6-SS	64				10		,
		25			50/51						
	00000	-	— 125 -	ر 7-SS	50/5"				9		
	.00	-	-								

Groundwater encountered at 19.5 feet Boring Terminated at about 30 feet (EL. 121')	
Water Observation Data	Remarks:
	100000000000000000000000000000000000000
☑ Water Encountered During Drilling:	CS = California Split Spoon
✓ Water Encountered During Drilling: ✓ Water Level At End of Drilling:	100000000000000000000000000000000000000
<ul> <li>         ∑ Water Encountered During Drilling:     </li> <li>         Water Level At End of Drilling:     </li> </ul>	CS = California Split Spoon

#### BORING NO. & LOCATION: **TEST BORING LOG** B-6 SURFACE ELEVATION: PROPOSED PUBLIC STORAGE REDEVELOPMENT 142 feet COMPLETION DATE: 1800 124TH AVENUE NE 11/29/17 BELLEVUE, WA GILES ENGINEERING ASSOCIATES, INC. FIELD REP: TREVOR SLAZAS PROJECT NO: 2G-1710005 Sample No. & Type Depth (ft) $Q_u$ Q<sub>p</sub> Q, W MATERIAL DESCRIPTION N PID (tsf) (tsf) (tsf) (%) Approximately 1.5 inches of asphaltic concrete Gray fine Sandy Silt, some Clay, Some Gravel - Moist (Possible Native) 1-SS 63 13 140.0 2.5 Light Brown Silty fine to coarse Sand, some Gravel, possible Cobbles - Moist 2-SS 50/3" 14 0 137. 0 5.0 0 3-SS 50/3" 12 135.0 0 No groundwater encountered Boring Terminated at about 7.5 feet (EL. 134.5)

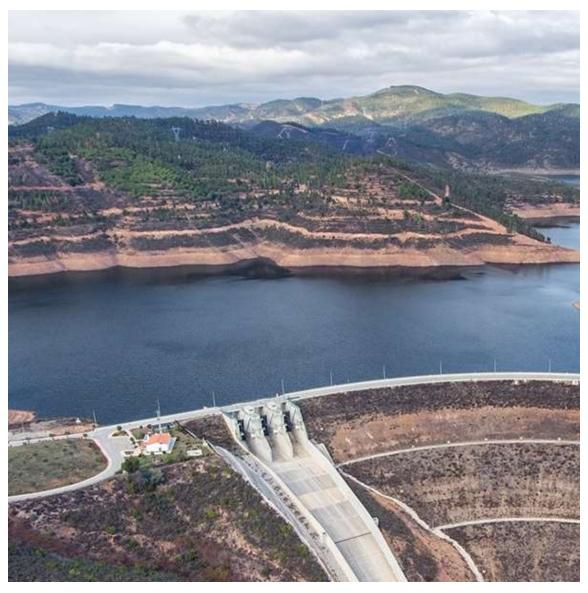
NOTES

Bo Bo	oring Terminated at about 7.5 feet (EL. 4.5')		
26-1710	Water Observation Data	Remarks:	
	Water Encountered During Drilling: None	SS = Standard Penetration Test	
REPORT ₹	Water Level At End of Drilling:		
E 00 P	Cave Depth At End of Drilling:		
S LS	Water Level After Drilling:		
GILES	Cave Depth After Drilling:		

# APPENDIX D Slope Stability Analysis Report



# \_\_\_ rocscience



Bellevue Public Storage Access Road Slope Stability SLIDE - An Interactive Slope Stability Program Date Created: 11/25/2020, 10:36:42 AM Software Version: 9.009

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Method: spencer	9
Method: gle/morgenstern-price	9
Group 2 - With Roadway - Scenario 3 - Pseudostatic no Surcharge 1	10
Method: spencer 1	10
Method: ale/margenstern-price	10

# **Slide Analysis Information**

# **Bellevue Public Storage Access Road Slope Stability**

# **Surface Options**

#### Group 1 - Current Condition

Surface Type: Circular

Search Method: Auto Refine Search

Divisions along slope:

Circles per division:

Number of iterations:

Divisions to use in next iteration:

Composite Surfaces:

Minimum Elevation:

Divisions to use in Not Defined

Minimum Depth [ft]: 5

Minimum Area: Not Defined Minimum Weight: Not Defined

## Group 2 - With Roadway

Surface Type: Circular

Search Method: Auto Refine Search

20 Divisions along slope: Circles per division: 10 Number of iterations: 10 50% Divisions to use in next iteration: Composite Surfaces: Disabled Minimum Elevation: Not Defined Minimum Depth: Not Defined Minimum Area: Not Defined Minimum Weight: Not Defined

# **Seismic Loading**

## ♦ Group 2 - With Roadway - Master Scenario

Advanced seismic analysis: No Staged pseudostatic analysis: No

#### **All other Scenarios**

Advanced seismic analysis:

Staged pseudostatic analysis:

No
Seismic Load Coefficient (Horizontal):

0.223

# Loading

# ♦ Group 2 - With Roadway - Scenario 1 - With Surcharge

Distribution: Constant Magnitude [psf]: 250

Orientation: Normal to boundary

# **Materials**

Weathered Till	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	135
Cohesion [psf]	0
Friction Angle [deg]	39
Water Surface	Assigned per scenario
Ru Value	0
Glacial Till	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	135
Cohesion [psf]	0
Friction Angle [deg]	40
Water Surface	Assigned per scenario
Hu Value	1
roadway backfill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	130
Cohesion [psf]	0
Friction Angle [deg]	36
Water Surface	Assigned per scenario
Ru Value	0

# Materials In Use

Material	Group 1 - Current Condition	Pseudostati c	Group 2 - With Roadway	Scenario 1 - With Surcharge	Scenario 2 - Pseudostati c with Surcharge	Scenario 3 - Pseudostati c no Surcharge
Weathered Till	1	1	1	1	/	<b>✓</b>
Glacial Till	1	1	1	1	1	<b>✓</b>
roadway backfill	×	×	✓	<b>✓</b>	<b>✓</b>	<b>✓</b>

# **Global Minimums**

# Group 1 - Current Condition - Master Scenario

# **Method: spencer**

FS	1.162820
Center:	100.542, 96.805
Radius:	57.627
Left Slip Surface Endpoint:	102.837, 39.224
Right Slip Surface Endpoint:	139.672, 54.501
Resisting Moment:	604775 lb-ft
Driving Moment:	520091 lb-ft
Resisting Horizontal Force:	9610.7 lb
Driving Horizontal Force:	8264.96 lb
Total Slice Area:	113.015 ft2
Surface Horizontal Width:	36.835 ft
Surface Average Height:	3.06813 ft

## Method: gle/morgenstern-price

FS	1.161030
Center:	100.624, 96.688
Radius:	57.485
Left Slip Surface Endpoint:	102.950, 39.250
Right Slip Surface Endpoint:	139.672, 54.501
Resisting Moment:	601319 lb-ft
Driving Moment:	517917 lb-ft
Resisting Horizontal Force:	9586.58 lb
Driving Horizontal Force:	8256.94 lb
Total Slice Area:	112.822 ft2
Surface Horizontal Width:	36.7218 ft
Surface Average Height:	3.07235 ft

# Group 1 - Current Condition - Pseudostatic

#### **Method: spencer**

FS	1.162820
Center:	100.542, 96.805
Radius:	57.627
Left Slip Surface Endpoint:	102.837, 39.224
Right Slip Surface Endpoint:	139.672, 54.501
Resisting Moment:	604775 lb-ft
Driving Moment:	520091 lb-ft
Resisting Horizontal Force:	9610.7 lb
Driving Horizontal Force:	8264.96 lb
Total Slice Area:	113.015 ft2
Surface Horizontal Width:	36.835 ft
Surface Average Height:	3.06813 ft

## Method: gle/morgenstern-price

FS	1.161030
Center:	100.624, 96.688
Radius:	57.485
Left Slip Surface Endpoint:	102.950, 39.250
Right Slip Surface Endpoint:	139.672, 54.501
Resisting Moment:	601319 lb-ft
Driving Moment:	517917 lb-ft
Resisting Horizontal Force:	9586.58 lb
Driving Horizontal Force:	8256.94 lb
Total Slice Area:	112.822 ft2
Surface Horizontal Width:	36.7218 ft
Surface Average Height:	3.07235 ft

# ♦ Group 2 - With Roadway - Master Scenario

## **Method: spencer**

FS	2.731910
Center:	76.282, 160.434
Radius:	123.857
Left Slip Surface Endpoint:	80.527, 36.650
Right Slip Surface Endpoint:	140.645, 54.614
Resisting Moment:	2.09602e+06 lb-ft
Driving Moment:	767237 lb-ft
Resisting Horizontal Force:	16138.9 lb
Driving Horizontal Force:	5907.53 lb
Total Slice Area:	163.19 ft2
Surface Horizontal Width:	60.1185 ft
Surface Average Height:	2.71447 ft

## Method: gle/morgenstern-price

FS	2.735180
Center:	76.282, 160.434
Radius:	123.857
Left Slip Surface Endpoint:	80.527, 36.650
Right Slip Surface Endpoint:	140.645, 54.614
Resisting Moment:	2.09853e+06 lb-ft
Driving Moment:	767237 lb-ft
Resisting Horizontal Force:	16141.9 lb
Driving Horizontal Force:	5901.58 lb
Total Slice Area:	163.19 ft2
Surface Horizontal Width:	60.1185 ft
Surface Average Height:	2.71447 ft

# ♦ Group 2 - With Roadway - Scenario 1 - With Surcharge

**Method: spencer** 

**FS** 2.704480 Center: 77.990, 161.556 124.809 Radius: Left Slip Surface Endpoint: 81.610, 36.799 Right Slip Surface Endpoint: 142.473, 54.695 **Resisting Moment:** 2.47993e+06 lb-ft Driving Moment: 916973 lb-ft Resisting Horizontal Force: 18911.2 lb **Driving Horizontal Force:** 6992.54 lb Total Slice Area: 186.716 ft2 Surface Horizontal Width: 60.8627 ft Surface Average Height: 3.06782 ft

#### Method: gle/morgenstern-price

FS 2.708000 Center: 77.990, 161.556 124.809 Radius: Left Slip Surface Endpoint: 81.610, 36.799 Right Slip Surface Endpoint: 142.473, 54.695 **Resisting Moment:** 2.48316e+06 lb-ft Driving Moment: 916973 lb-ft Resisting Horizontal Force: 18915 lb **Driving Horizontal Force:** 6984.89 lb Total Slice Area: 186.716 ft2 Surface Horizontal Width: 60.8627 ft Surface Average Height: 3.06782 ft

# Group 2 - With Roadway - Scenario 2 - Pseudostatic with Surcharge

#### Method: spencer

FS 1.477110 Center: 75.218, 161.294 124.872 Radius: Left Slip Surface Endpoint: 79.444, 36.494 Right Slip Surface Endpoint: 140.078, 54.588 **Resisting Moment:** 1.89684e+06 lb-ft Driving Moment: 1.28416e+06 lb-ft Resisting Horizontal Force: 14537.8 lb **Driving Horizontal Force:** 9842.05 lb Total Slice Area: 156.729 ft2 Surface Horizontal Width: 60.6344 ft Surface Average Height: 2.58483 ft

# Method: gle/morgenstern-price

FS	1.477580
Center:	75.218, 161.294
Radius:	124.872
Left Slip Surface Endpoint:	79.444, 36.494
Right Slip Surface Endpoint:	140.078, 54.588
Resisting Moment:	1.89745e+06 lb-ft
Driving Moment:	1.28416e+06 lb-ft
Resisting Horizontal Force:	14539.1 lb
Driving Horizontal Force:	9839.81 lb
Total Slice Area:	156.729 ft2
Surface Horizontal Width:	60.6344 ft
Surface Average Height:	2.58483 ft

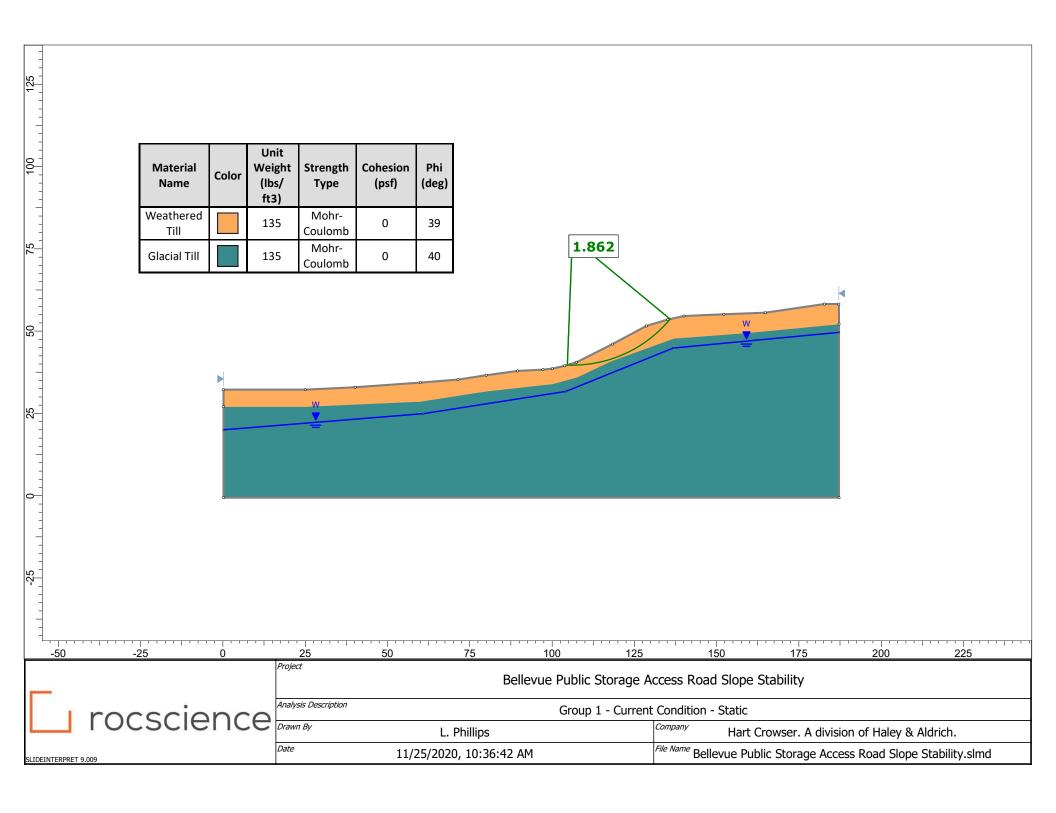
# ♦ Group 2 - With Roadway - Scenario 3 - Pseudostatic no Surcharge

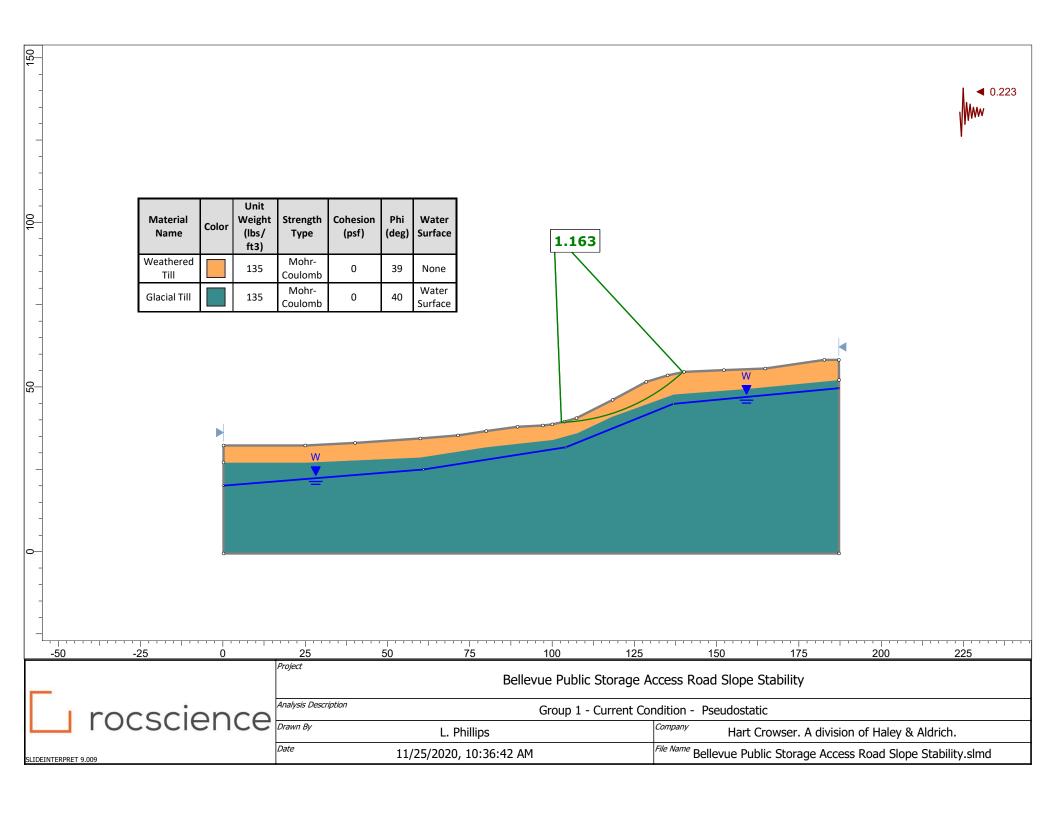
## **Method: spencer**

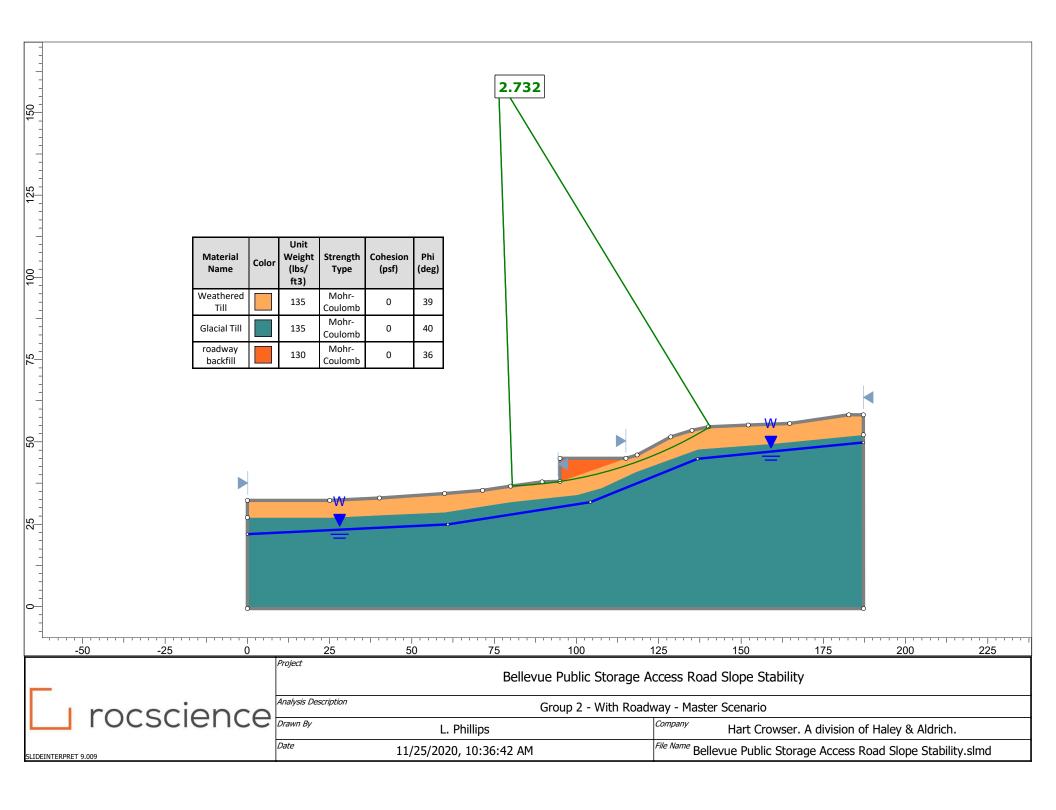
FS	1.477110
Center:	75.218, 161.294
Radius:	124.872
Left Slip Surface Endpoint:	79.444, 36.494
Right Slip Surface Endpoint:	140.078, 54.588
Resisting Moment:	1.89684e+06 lb-ft
Driving Moment:	1.28416e+06 lb-ft
Resisting Horizontal Force:	14537.8 lb
Driving Horizontal Force:	9842.05 lb
Total Slice Area:	156.729 ft2
Surface Horizontal Width:	60.6344 ft
Surface Average Height:	2.58483 ft

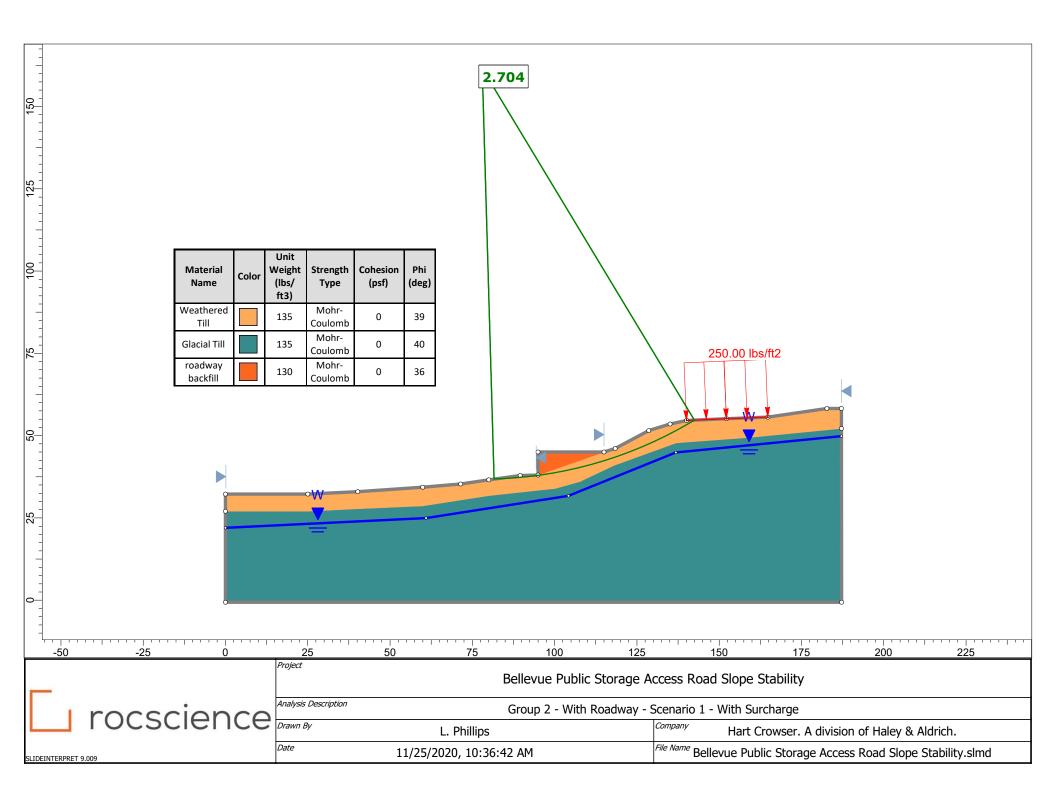
# Method: gle/morgenstern-price

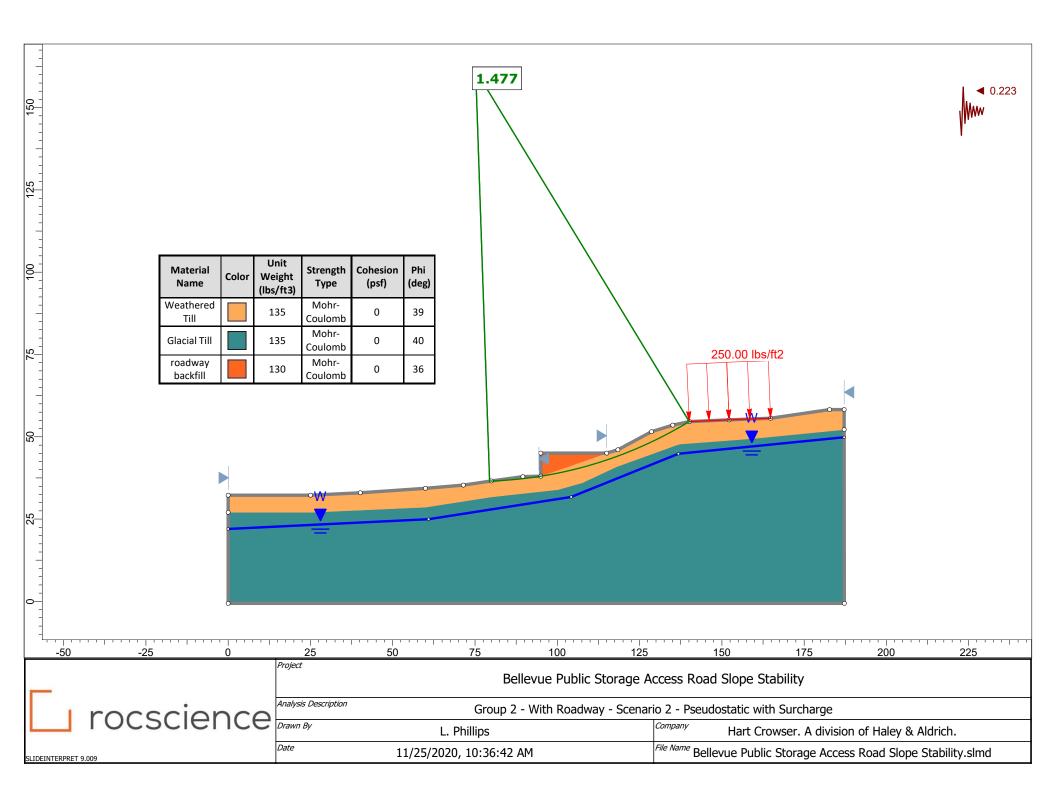
FS	1.477580
Center:	75.218, 161.294
Radius:	124.872
Left Slip Surface Endpoint:	79.444, 36.494
Right Slip Surface Endpoint:	140.078, 54.588
Resisting Moment:	1.89745e+06 lb-ft
Driving Moment:	1.28416e+06 lb-ft
Resisting Horizontal Force:	14539.1 lb
Driving Horizontal Force:	9839.81 lb
Total Slice Area:	156.729 ft2
Surface Horizontal Width:	60.6344 ft
Surface Average Height:	2.58483 ft

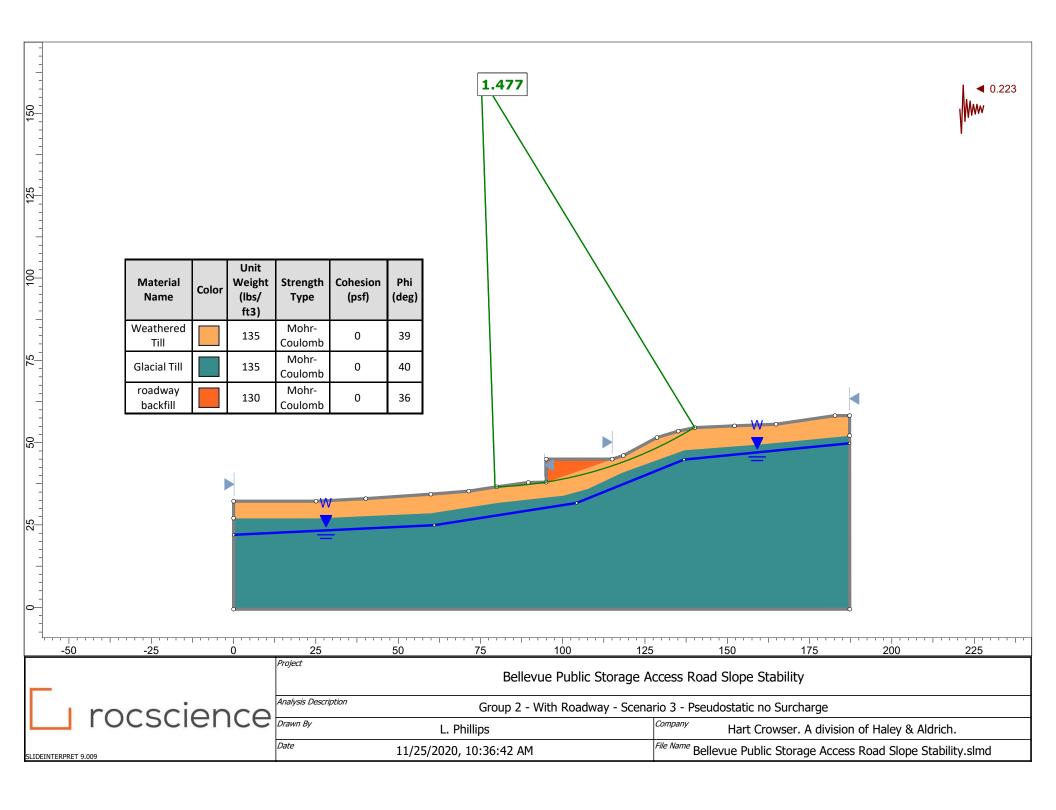






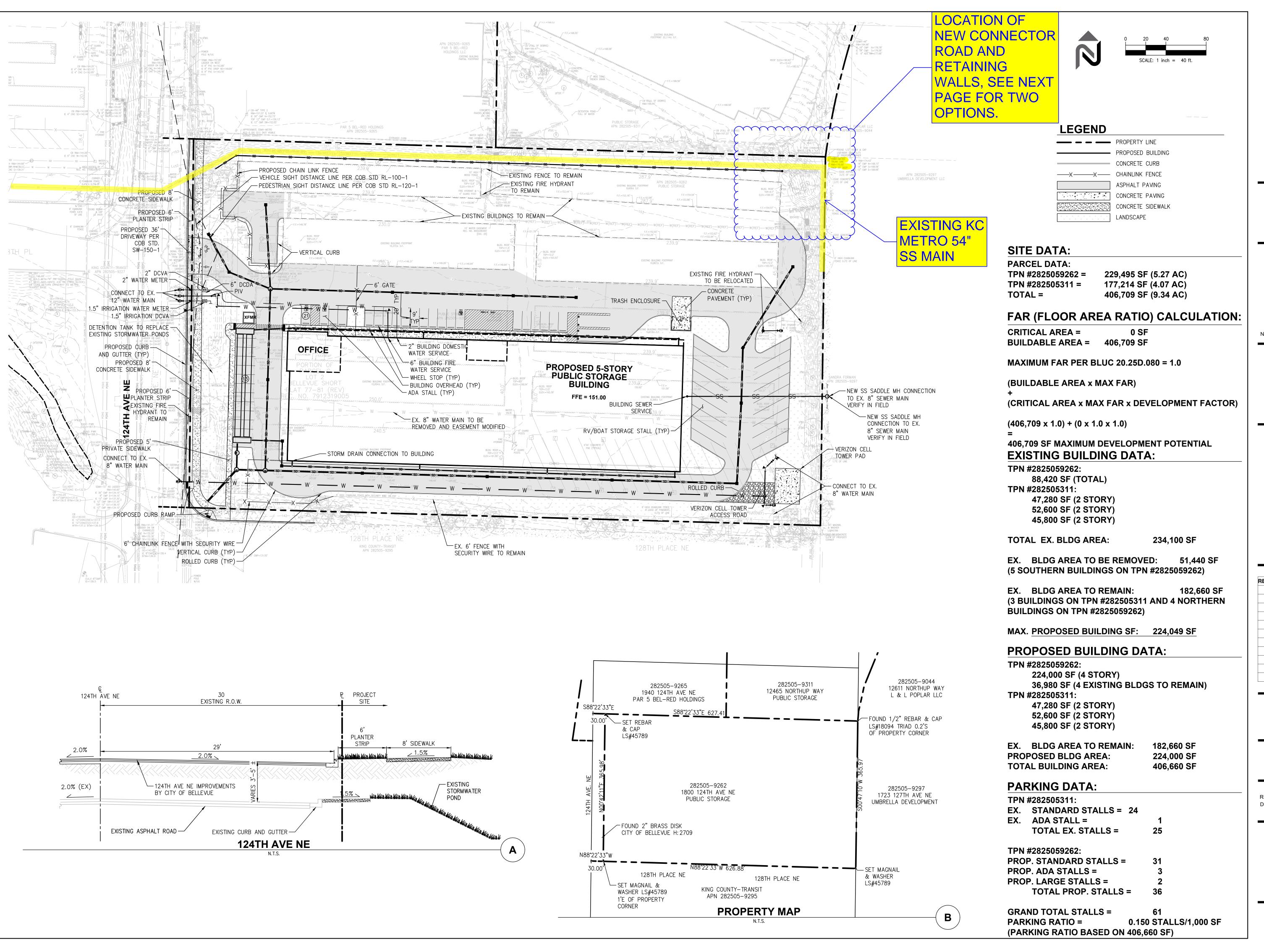






# ATTACHMENT 1 Navix Site Plan - Proposed Roadway





SITE | CIVIL

11235 se 6th street | suite 150 bellevue, wa 98004 t: 425.453.9501 | f: 425-453-8208

**CLIENT/OWNER** 

www.navixeng.com

**PUBLIC STORAGE** 

**PROJECT NAME** 

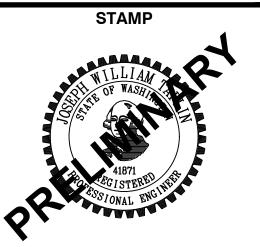
#08193

# **PUBLIC STORAGE**

NAVIX PROJECT NUMBER:

**PROJECT ADDRESS** 

**1800 124TH AVE NE BELLEVUE, WA 98005** 



	REVISIONS		
REV	ISSUED FOR:	DATE	
	DESIGN REVIEW	10.30.19	



SECTION, TOWNSHIP, RANGE: SW 1/4 OF NE 1/4 OF SECTION 28, TOWNSHIP 25 NORTH, RANGE 5 EAST, W.M.

PROJECT TEAM J.TAFLIN REVIEWED BY:

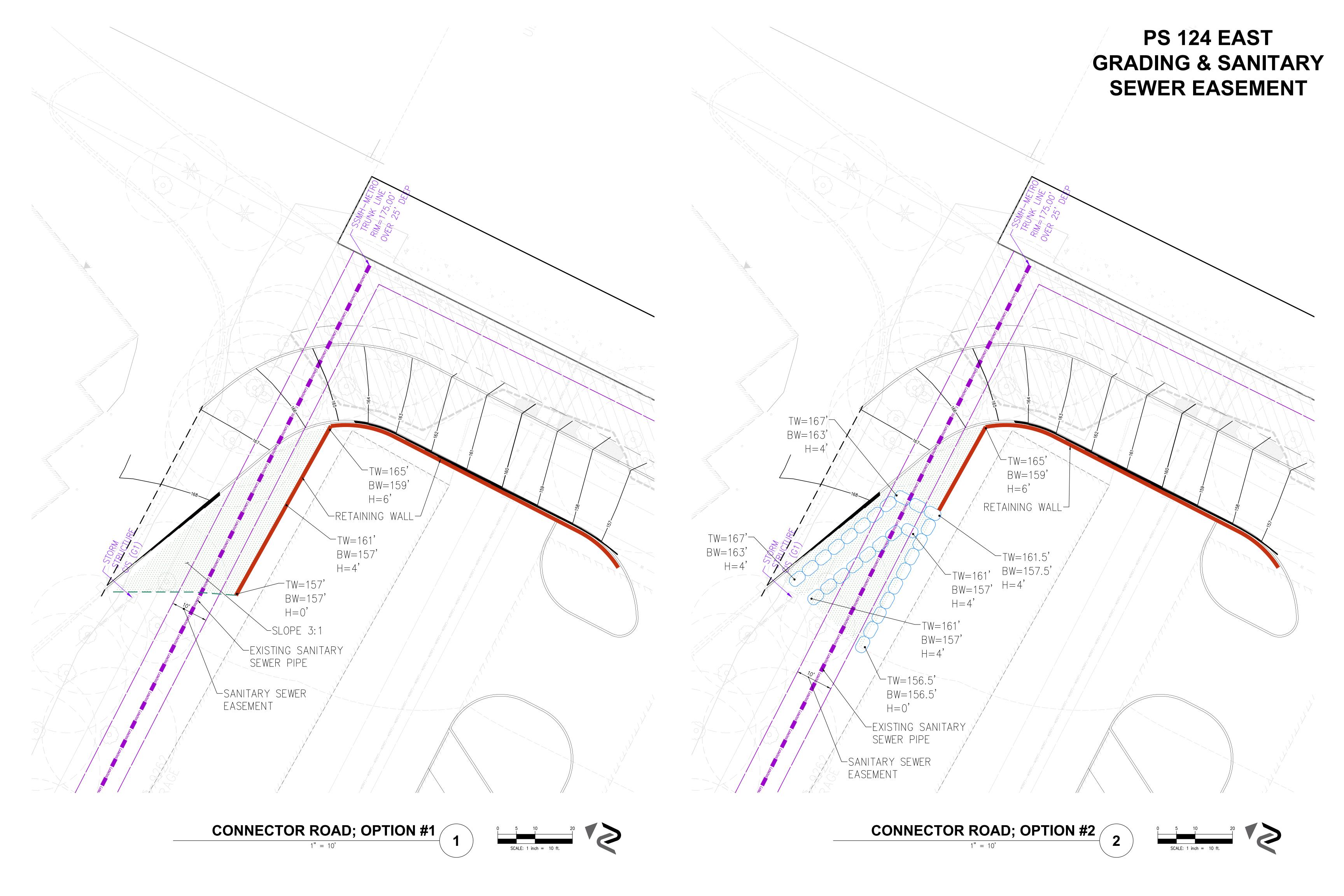
A. TSAI J.GREEN DESIGNED BY: K. GREKOV

SHEET NAME

SITE PLAN B

SHEET NUMBER

C2.00







# **Geotechnical Engineering Exploration and Analysis**

Proposed Public Storage Redevelopment 1800 124<sup>th</sup> Avenue NE Bellevue, Washington

Prepared for:

Public Storage Glendale, California

February 14, 2018 Project No. 2G-1710005







GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

February 14, 2018

· Atlanta, GA

- · Baltimore, MD
- Dallas, TX
- · Los Angeles, CA
- Manassas, VA

· Milwaukee, WI

Public Storage, Inc. 701 Western Avenue

Glendale California 91201

Attention: Mr. Bryan Miranda

Vice President

Subject:

Geotechnical Engineering Exploration and Analysis

Proposed Pubic Storage Redevelopment

1800 124th Avenue NE Bellevue, Washington Project No. 2G-1710005

Dear Mr. Miranda:

In accordance with your request and authorization, a Geotechnical Engineering Exploration and Analysis report has been prepared for the above-referenced project. Conclusions and recommendations developed from the exploration and analysis are discussed in the accompanying report.

We appreciate the opportunity to be of service on this project. If we may be of additional assistance, should geotechnical related problems occur or to provide construction observation and testing services, please do not hesitate to call at any time.

Respectfully submitted,

GILES ENGINEERING ASSOCIATES, INC.

Edgar L. Gatus

Assistant Branch Manager

Terry L. Giles, P.E., G.E.

EXPIRES

President and CEO

Distribution: Public Storage, Inc.

Attn.: Mr. Bryan Miranda (2 copies, email: bmiranda@publicstorage.com)

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Appendix D – General Information (Modified Guideline Specifications) and Important Information
About Your Geotechnical Report



#### **GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS**

PROPOSED PUBLIC STORAGE REDEVELOPMENT 1800 124<sup>TH</sup> AVENUE NE BELLEVUE, WASHINGTON PROJECT NO. 2G-1710005

#### 1.0 EXECUTIVE SUMMARY OUTLINE

The executive summary is provided solely for purposes of overview. Any party who relies on this report must read the full report. The executive summary omits a number of details, any one of which could be crucial to the proper application of this report.

#### **Subsurface Conditions**

- Possible fill materials were encountered beneath the asphalt pavement within some of our exploratory borings to depths of approximately 3.5 to 8 feet below existing grade. These materials were noted to be generally moist, very loose to firm in relative density silty fine to coarse sand with some gravel.
- Based on a review of the Geologic Map of the Kirkland, Washington Quadrangle (1983), it appears that the site is underlain by recessional outwash deposits derived from the receding Vashon glacier. The soils within this unit are mostly stratified sands and gravels with minor silt and clay layers. This condition was generally confirmed during our subsurface exploration at the site. Possible native and native soils encountered beneath the possible fill soils and pavement consisted generally of moist to wet, firm to very dense sand, silty fine to coarse sand with some gravel, and medium stiff to hard in comparative consistency sandy silt. Possible cobbles and/or boulders were present in deeper soils.
- Groundwater was encountered within several of the borings at depths ranging from about 3 to 19.5 feet below grade during our drilling operations.
- Monitoring wells (W-1 to W-3) were installed at the site and indicated the rise of groundwater into
  the top of the monitoring well pipe (approximately at ground level) indicating in our opinion the
  presence of a surficial artesian aquifer that may result in specialized dewatering in deeper
  excavation such as encountered in the area of Boring No.5.

#### **Site Development**

- The existing storage buildings will be demolished for the construction of two three-story buildings with no basement or below grade structures.
- New Buildings: Due to the presence of variable strength, and low strength onsite soils, deep existing fill and the likely disturbance of the subgrade during demolition operations, it is recommended that the soils within the proposed new building area and an appropriate distance beyond (5 feet minimum where possible) be removed to a depth of at least 2 feet below existing grade, 2 feet below bottom of footings, or mat/slab, whichever is deeper and at least 3 feet and 8 feet below grade at Borings No. 3 and 5, respectively, and all other similar low strength areas. The soils exposed at the base of this recommended over-excavation should be examined by the geotechnical engineer to document that the soils are suitable for building support. Following documentation from the geotechnical engineer that the soils are suitable for building support, the soils exposed at the base of the over-excavation area should be compacted in-place to at least 90 percent of the soil's maximum dry density, per ASTM D-1557.

- Following site clearing and lowering of site grades where necessary, the subgrades within the new
  pavement areas should be proofrolled in the presence of the geotechnical engineer with
  appropriate rubber-tire mounted heavy construction equipment or a loaded truck to detect
  loose/soft yielding soil which should be removed to a stable subgrade or compacted in-place if
  feasible.
- Site Class D is recommended for seismic design considerations.
- Due to the presence of dense to very dense soils at depth and the recommended removal of the low strength materials during building pad preparation, the site is not considered to be susceptible to soil liquefaction during a seismic event.

#### **New Building Foundation**

- The proposed structure may be supported by a shallow spread footing foundation system and/or a mat/slab supported on a minimum 2 feet thick structural compacted fill layer designed for a maximum, net allowable soil bearing pressure of 3,500 pounds per square foot (psf) or a maximum modulus of subgrade reaction (k<sub>s</sub>) of 85 pounds per square inch per inch (psi/in.).
- Steel reinforcing should be per the structural engineer.

#### **New Floor Slab**

- The slab should be underlain by a minimum 4-inch thick granular base supported on a properly
  prepared subgrade consisting of newly placed structural compacted fill at least 2 feet thick. If the
  floor is designed as a conventional slab-on-grade, not supporting structural loads and independent
  of the foundation system, a subgrade modulus of 150 pci may be used for slab design.
- The ground floor of the new building may be designed as load-bearing mat/slab or as a conventional slab-on-grade.
- A minimum 15-mil vapor retarder is recommended to be directly below the floor slab or base course where required to protect moisture sensitive floor coverings.

#### **Pavement**

- Asphaltic Concrete: 3 inches of asphaltic concrete underlain by 4 or 6 inches of base course in parking stall and drive lane areas, respectively.
- Portland Cement Concrete: 6 inches in thickness in high stress areas such as entrance/exit aprons lane and in trash enclosure loading zone with a 4 inch granular base.

YELLOW – This site has been given a Yellow designation, due to increased costs associated with building pad preparation in consideration of overexcavation due to razing existing structures and existing fill (up to 8 feet in one area) in preparation of a structural fill layer below the structure, the disturbance and water sensitivity of the subgrade soil, and the potential for specialized dewatering due to a possible artesian condition that may develop in deeper excavations.



#### **2.0 SCOPE OF SERVICES**

This report provides the results of the *Geotechnical Engineering Exploration and Analysis* that Giles Engineering Associates, Inc. ("Giles") conducted regarding the proposed development. The *Geotechnical Engineering Exploration and Analysis* included several separate, but related, service areas referenced hereafter as the Geotechnical Subsurface Exploration Program, Geotechnical Laboratory Services, and Geotechnical Engineering Services. The scope of each service area was narrow and limited, as directed by our client and in consideration of the proposed project. The scope of each service area is briefly explained later.

Geotechnical engineering recommendations for design and construction of the foundations, floor slabs, and pavement for the proposed structures are provided in this report. Site preparation recommendations are also given; however, those recommendations are only preliminary since the means and methods of site preparation will depend on factors that were unknown when this report was prepared. Those factors include, but are not limited to, the weather before and during construction, subsurface conditions that are exposed during construction, and finalized details of the proposed development. Environmental consulting was beyond our authorized scope of services for this project.

#### 3.0 SITES AND PROJECT DESCRIPTION

#### 3.1 Site Description

The subject site is currently an existing Public Storage facility located at 1800 124<sup>th</sup> Avenue NE in the city of Bellevue, King County, Washington. The site is currently occupied by nine single-story storage buildings, an office building and asphalt paved parking and drive lane areas. Based on a visual examination, the existing building and asphalt pavements were assessed to be in fair condition. The roughly rectangular shaped subject lot is bordered on the north by an approximately 6 to 10-foot high ascending slope then several commercial buildings then Northrup Way, in the east by an approximately 5 to 15-foot high ascending slope then an industrial site, on the west by 124<sup>th</sup> Avenue NE and on the south by a private road and commercial buildings. The subject property is situated at approximately latitude 47.6279° North, longitude 122.1763° West and about 4 to 6 feet higher than the adjacent street (124<sup>th</sup> Avenue).

Based on a review of the site plan prepared by Navix Engineering, elevations within the site range from approximately El. 147 feet along the southwesterly corner property line to El. 153 feet along the northeasterly corner of the property line. The site drains by sheet flow to the west.

#### 3.2 Proposed Project Description

Based on the information provided, we understand that the existing buildings will be demolished for the construction of two new three story storage buildings (designated as north building and south building in this report). New limited parking lot and drive lanes and landscape areas are also anticipated. We anticipate that the new buildings will be supported by a perimeter load-bearing wall



and interior load bearing walls. Interior load bearing walls are typically spaced at about 10 feet oncenter often supported by the floor slab. The maximum combined live and dead load supported by the bearing walls is estimated to be about 3 and 4 kips per lineal foot (klf) for perimeter and interior load bearing walls, respectively. Interior columns are anticipated to have a maximum axial load of 40 kips. The live load supported by the ground floor slab is anticipated to be a maximum of 125 pounds per square foot (psf).

Other planned site improvements include concrete walkways and new pavements.

Preliminary project information did not indicate the planned finished floor elevation for the proposed new structures. However, it is anticipated that the finished floor elevation of the new buildings will closely match the finish floor of the existing buildings with the north and south buildings assumed finish floor elevation of El 150 and El 147, respectively. Therefore, site grading is anticipated to consist of cut and fill of about 2 to 3 feet except the southern corner of the south building where about 5 feet of fill will be required, to establish the necessary planned finish grade elevations, exclusive of site preparation and over-excavation requirements necessary to create a stable site suited for the proposed development.

It is anticipated that parking stalls and drive lanes will be constructed at the subject site. Parking stall pavements areas are expected to be subjected to passenger vehicle traffic only. The drive lanes are anticipated to be subjected to a daily traffic loading of 1 to 2 heavy trucks per day (5 Equivalent Single/Axle Loads) and pavement design is based on a 20 year pavement design life.

#### 4.0 SUBSURFACE EXPLORATION

#### 4.1 Subsurface Exploration

Our subsurface exploration consisted of drilling six (6) test borings (B-1 through B-6) at the approximate locations requested to depths ranging from approximately 7.5 to 46 feet below existing ground surface. The approximate test boring locations are shown in the Test Boring Location Plan (Figure 1). The Test Boring Location Plan and Test Boring Logs (Records of Subsurface Exploration) are enclosed in Appendix A. Field and laboratory test procedures and results are enclosed in Appendix B and C, respectively. The terms and symbols used on the Test Boring Logs are defined on the General Notes in Appendix D.

Where deemed appropriate, standard split-spoon tests (SS), also called Standard Penetration Test (SPT), were performed at selected depth intervals in accordance with the American Society for Testing Materials (ASTM) Standard Procedure D 1586. This method consists of mechanically driving an unlined standard split-barrel sampler 18 inches into the soil with successive 30-inch drops of the 140-pound automatic trip hammer. Blow counts for each 6-inch driving increment were recorded on the exploration logs. The number of blows required to drive the standard split-spoon sampler for the last 12 of the 18 inches was identified as the uncorrected standard penetration resistance (N). Disturbed soil samples from the unlined standard split-spoon samplers were placed in plastic containers and transported to our laboratory for testing.



#### 4.2 **Subsurface Conditions**

The subsurface conditions as subsequently described have been simplified somewhat for ease of report interpretation. A more detailed description of the subsurface conditions at the test boring locations is provided by the logs of the test borings enclosed in Appendix B of this report.

#### **Existing Pavement**

Existing pavement encountered within our test borings consisted of approximately 1.5 to 4 inches thick asphalt concrete with 1 to 5 inches of aggregate base observed under the asphalt. No aggregate base was observed in borings B-2, and B-6. Based on our visual observation, the existing asphalt pavement is in fair to poor condition.

#### Possible Fill Soil

Possible fill materials were encountered beneath the asphalt pavement within some of our exploratory borings to depths of approximately 3.5 to 8 feet below existing grade. These materials were noted to be generally moist, very loose to firm in relative density silty fine to coarse sand with some gravel.

#### Possible native and Native Soil

Based on a review of the *Geologic Map of the Kirkland, Washington Quadrangle* (1983), in general the site is underlain by recessional outwash deposits derived from the receding Vashon glacier. The soils within this unit are mostly stratified sands and gravels with minor silt and clay layers. This condition was generally confirmed during our subsurface exploration at the site. Possible native and native soils encountered beneath the possible fill soils and pavement consisted generally of moist to wet, firm to very dense relative density sand, silty fine to coarse sand with some gravel, and medium stiff to hard comparative consistency sandy silt. Possible cobbles and/or boulders were present in deeper soils.

#### Groundwater

Groundwater was encountered within several of the borings at depths ranging from about 3 to 19.5 feet below grade during our drilling operations. Monitoring Wells (W-1 to W-3) were installed and measured the following days. A summary of the groundwater conditions encountered is summarized in the following table.



TABLE 1
Groundwater Elevation Measurements

Test Boring/Well	Date Recorded	Approximate Surface Elevation	Depth to Water (ft)	Approx. Water Elevation (feet)
Number		(ft)		
B-1 (W-1)	12/1/17	151	Top of Pipe	El. 151
B-4 (W-2)	12/1/17	153	Top of Pipe	El. 153
B-5 (W-3)	12/1/17	150	1.82 ' below top of pipe	El. 148.2

<sup>\*</sup> Groundwater measured 24 hours after drilling on 11/30/17

The rise of groundwater the following day into the top of the monitoring well pipe (approximately at ground level) indicated in our opinion the presence of surficial artesian aquifer. The depth of this surficial artesian aquifer is estimated to be about 15 to 20 feet below the existing ground surface, but may be shallower in some portions of the site.

#### **5.0 LABORATORY TESTING**

Several laboratory tests were performed on selected samples considered representative of those encountered in order to evaluate the engineering properties of on-site soils underlying the site. The following are brief description of our laboratory test results.

#### In Situ Moisture

Tests were performed on select samples from the test borings to determine the subsoil's natural moisture contents in accordance with Test Method ASTM 2216-05. The results of these tests are included in the Test Boring Logs enclosed in Appendix A.

#### Atterberg Limits

The Atterberg Limits (liquid limit, plastic limit, and plasticity index) were determined for a representative sample of the clayey soil at Test Boring B-3 in accordance with Test Method ASTM D 4318 for determination of soil classification and properties. The results of the Atterberg Limit tests are included on the Test Boring Logs enclosed in Appendix A.

#### **Consolidation Test**

Settlement (swell/collapse) predictions under anticipated loads were made on the basis of one-dimensional consolidation tests. These tests were performed in general accordance with Test Method ASTM D 2435 and ASTM D 5333. The test samples were inundated in order to evaluate the sudden increase in moisture condition (swell or collapse potential). Results of these tests indicated that on-site soils exhibit slight collapse potential (0.10% and 0.45%). The Consolidation test curves, Figures 2 to 5 are included in Appendix A.



#### Soluble Sulfate Analysis and Soil Corrosivity

A representative sample of the near surface soils which may contact shallow buried utilities and structural concrete was performed to determine the corrosion potential for buried ferrous metal conduits and the concentrations present of water soluble sulfate which could result in chemical attack of cement. The following table presents the results of our laboratory testing.

Parameter	B-1 @ 1-5 feet
рH	7.77
Chloride	100 ppm
Sulfate	0.0237%
Resistivity	4,300 ohm-cm

The chloride content of near-surface soils was determined for a select sample with results of this test indicating that tested on-site soils have a Low exposure to chloride.

The results of the soil pH test, indicated the tested soils are slightly alkaline, and based on the laboratory resistivity test, the tested soils were found to be *moderately corrosive* when in contact with ferrous materials. These test results have been evaluated in accordance with criteria established by the Cast Iron Pipe Research Association, Ductile Iron Pipe Research Association, the American Concrete Institute and the National Association of Corrosion Engineers.

Corrosivity testing also included determination of the concentrations of water-soluble sulfates present in the tested soil sample. Our laboratory test data indicated that the tested near surface soils contain approximately 0.0237 percent of water soluble sulfates. A negligible exposure to sulfate can be expected for concrete placed in contact with the on-site soils. No special sulfate resistant cement is considered necessary for concrete which will be in contact with the tested on-site soils.

#### **6.0 CONCLUSIONS AND RECOMMENDATIONS**

Conditions imposed by the proposed development have been evaluated on the basis of the assumed floor elevation and engineering characteristics of the subsurface materials encountered during our subsurface investigation and their anticipated behavior both during and after construction. Conclusions and recommendations presented for the design of building foundations, building floor slab, and parking lot pavement, along with site preparation recommendations and construction considerations are discussed in the following sections of this report.

#### 6.1 <u>Seismic Design Considerations</u>

#### Seismic Design

The site may be subject to seismic activity. The proposed structure should be designed in accordance with the current version of the 2015 International Building Code (IBC) and applicable local codes. Based upon the encountered subsurface soils and the geologic mapping, a Site Class D is recommended for design.

Within the International Code Council's 2015 International Building Code (IBC), the five-percent damped design spectral response accelerations at short periods,  $S_{DS}$ , and at 1-second period,  $S_{D1}$ , are used to determine the seismic design base shear. These parameters, which are a function of the site's seismicity and soil, are also used as parts of triggers for other code requirements. The following values are determined by using USGS Design Maps. The location used for the site is latitude  $47.6272^{\circ}$  north, longitude  $-122.1736^{\circ}$  west.

IBC 2015, Earthquake Loads			
Site Class Definition (Table 1613.5.2)			
Mapped Spectral Response Acceleration Parameter, S <sub>s</sub> (Figure 1613.3.1(1) for 0.2 second)			
Mapped Spectral Response Acceleration Parameter, S <sub>1</sub> (Figure 1613.3.1(2) for 1.0 second)			
Site Coefficient, F <sub>a</sub> (Table 1613.3.3 (1) 0.2-second short period)			
Site Coefficient, F <sub>v</sub> (Table 1613.3.3 (2) 1-second period)			
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter, S <sub>MS</sub> (Eq. 16-37)			
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter, S <sub>M1</sub> (Eq. 16-38)			
Design Spectral Response Acceleration Parameter, S <sub>DS</sub> (Eq. 16-39)			
Design Spectral Response Acceleration Parameter, S <sub>D1</sub> (Eq. 16-40)			

#### Liquefaction

According to the *Liquefaction Susceptibility Map prepared by King County Flood Control District*, the site is mapped as possessing a low to moderate liquefaction susceptibility. Based on this designation, an assessment of the liquefaction potential was performed.

One test boring (B-3) was drilled at the site to a depth of 46 feet and encountered very dense fine to coarse sands with gravel and possible cobbles and/or boulders. Groundwater was encountered at a depth of about 3 to 19.5 feet below grade during our drilling.

To assess the potential for soil liquefaction and the resulting seismic-induced settlement, a liquefaction analysis was performed. For this analysis, we utilized the soil profile identified in Test Boring B-3, an assumed water table at a depth of 8 feet and a site acceleration of 0.525g (PGA<sub>M</sub>)



obtained from the USGS website. The analysis was performed using the computer software program LiquifyPro. The results of this analysis indicate that the site soils are not subject to soil liquefaction upon application of the seismic earthquake. Some minor dry settlement is estimated for that portion of the soil profile above the assumed water table of 8 feet. For the analysis performed, the dry settlement during seismic activity is estimated to be approximately less than ¼ inch. Additional consideration with respect to seismic related settlement, the low strength materials in Boring No. 3 and 5 to a depth of 3 feet and 8 feet, respectively, are recommended to be removed and replaced with structural fill during site grading.

#### 6.2 Site Development Recommendations

The recommendations for site development as subsequently described are based upon the conditions encountered at the test boring locations and the results of our laboratory testing and liquefaction analysis. Moist to very moist soil conditions were encountered within some of the near surface soils during our subsurface exploration. It is expected that similar conditions are likely to be encountered during grading operations. Grading operations may require significant provisions for drying of the site soils prior to compaction. In addition, due to the presence of moist to very moist soil at the proposed remedial grading depths, the loads imposed by heavy rubber-tired equipment during grading may induce localized pumping of the subgrade that will require stabilization prior to fill placement. Groundwater, perched water and/or artesian water is expected to be encountered during remedial grading requiring specialized dewatering. The grading contractor should therefore include contingencies for air-drying of excessively moist soil, as well as the stabilization of the excavation bottoms in their bids, and dewatering. Imported granular soils or chemical modification of the soils may be required for excavation stabilization or replacement of the site soils if the soils cannot be effectively air-dried due to space, time constraints or weather.

The following recommendations for site development have been based upon the assumed floor elevation and new foundation bearing grades, the conditions encountered at the test boring locations and the time of year in which the exploration was performed.

#### Site Clearing

Clearing operations for the proposed development will include demolition and removal of the existing buildings and pavements within the new building and pavement areas. Demolition should include removal of all foundations, floor slabs and any below-grade construction. Clearing should also include the removal of any vegetation and debris within the proposed site development area. Trees and large shrubs to be removed should be grubbed out to include their stumps and major root systems.

Existing pavement within areas of proposed new development should be removed or processed to a maximum 3-inch size and stockpiled for use as compacted fill or stabilizing material for the new development. Processed asphalt may be used as fill, sub-base course material, or subgrade stabilization material beyond the building perimeter. Processed concrete may be used as fill, sub-base course material, or subgrade stabilization material both within and outside of the building perimeter,



but may create problems in storm water management systems and should be approved by the manufacturer. Due to the moisture sensitivity of the on-site soils, the pavement is recommended to remain in-place as long as possible to help protect the subgrade from construction traffic disturbance. All soils disturbed by the demolition of the existing improvements should be removed to a suitable subgrade, as determined by the project geotechnical engineer.

Should any unusual soil conditions or subsurface structures be encountered during demolition operations, they should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations.

#### **Existing Utilities**

All existing utilities should be located. Utilities that will be preserved are recommended to be relocated outside the building area. Utilities that are not reused should be capped off and removed or properly abandoned in-place in accordance with local codes and ordinances. The excavations made for removed utilities that are in the influence zone of new construction are recommended to be backfilled with structural compacted fill. Underground utilities, which are to be reused or abandoned in-place, are recommended to be evaluated by the structural engineer and utility backfill is recommended to be evaluated by the geotechnical engineer, to determine their potential effect on the new development. If any existing utilities are to be preserved, grading operations must be carefully performed so as not to disturb or damage the existing utility.

#### Building Pad Preparation

Due to the presence of relatively variable strength and low strength onsite soils, deep existing fill and the likely soil disturbance of the subgrade during demolition of the existing buildings, it is recommended that the soils within the proposed new building areas and an appropriate distance beyond (5 feet minimum where possible) be removed to a depth of at least 2 feet below existing grade, 2 feet below bottom of footings, and/or mat/slab, whichever is deeper and to a depth of at least 3 feet at Boring No. 3 and 8 feet at Boring No. 5 and all other areas with similar low strength materials encountered during grading and/or foundation or utility construction. The soils exposed at the base of this recommended over-excavation should be examined by the geotechnical engineer to document that the soils are suitable for building support. Following documentation from the geotechnical engineer that the soils are suitable for building support, the soils exposed at the base of the over-excavation area should be compacted in-place to at least 90 percent of the soil's maximum dry density, per ASTM D-1557. The excavation may then be backfilled with structural fill placed and compacted as described later in this report and in accordance with the enclosed structural fill guide specifications including benching excavation stage slopes.

#### Proofroll and Compact Subgrade

Following site clearing and lowering of site grades where necessary, the subgrades within the proposed new pavement areas should be proofrolled in the presence of the geotechnical engineer with appropriate rubber-tire mounted heavy construction equipment or a loaded truck to detect



loose/soft yielding soil which should be removed to a stable subgrade or compacted in-place if feasible. Following proofrolling and completion of any necessary over-excavation, the subgrades should be scarified to a minimum depth of 6 inches, moisture conditioned and recompacted to at least 90 percent of the Modified Proctor (ASTM D1557-00) maximum density. Low areas and excavations may then be backfilled in lifts with suitable low expansive (PI<15) structural compacted fill. The selection, placement and compaction of structural fill should be performed in accordance with the project specifications. The Guide Specifications included in Appendix D (Modified Proctor) of this report are recommended to be used as an aid in developing the project specifications. The floor slab or mat/slab and pavement subgrades may need to be recompacted prior to slab and pavement construction due to weather and equipment traffic effects on the previously compacted soil.

### **Dry Weather/Conditions Grading**

Site preparation and grading activities conducted during dry, fair weather conditions, are not expected to require additional over-excavation or undercutting due to weather related unstable soil conditions, provided the subgrade is initially in stable condition and construction traffic does not disturb the near surface soil. However, as noted in the <u>Building Pad Preparation</u> section of this report, soil over-excavation is recommended due to the presence of low strength soils.

#### Wet Weather/Conditions Construction

Subgrade stability problems should be expected if site development and grading activities are conducted during wet weather. If subgrade stability problems are encountered, undercutting on the order of 8 to 12 inches or more should be expected to be necessary (potentially after each rain event) to achieve a stable subgrade. The estimated depth of over-excavation is based upon the moisture sensitivity of the soils and the anticipated effect of wet weather grading. Alternatively, subgrade stability may be achieved by chemical modification of the soils through the addition of hydrated lime or Portland cement (depending upon soil type and testing soils sensitivity to modification) followed by proper compaction or through placement of a coarse aggregate working mat. If over-excavation or specialized subgrade stabilization techniques are required, the actual depth of over-excavation or stabilization method should be determined by a representative of the geotechnical engineer to provide the appropriate recommendations based on field evaluation and testing.

#### Reuse of On-site Soil

On-site material may be reused as structural compacted fill, during favorable weather conditions, within the proposed building and pavement area provided they do not contain oversized materials (+3 inches) and significant quantities of organic matter or other deleterious materials. However, the use of a select import fill may be desired/needed during cool and moist climatic conditions to achieve a soil moisture content suitable to achieve the required degree of compaction.



Care should be used in controlling the moisture content of the soils to achieve proper compaction for load bearing and pavement support. Drying of overly moist soil should be expected. All subgrade soil compaction as well as the selection, placement and compaction of new fill soils should be performed in accordance with the project specifications under engineering controlled conditions.

#### Import Structural Fill

The soils imported to the site for use as structural fill should consist of low expansive (PI<15) soils with not more than 12 percent passing the No. 200 sieve (silt and clay size). Material designated for import should be submitted to the project geotechnical engineer no less than three working days for evaluation. In addition to expansion criteria, soils imported to the site should exhibit adequate shear strength characteristics for the recommended allowable soil bearing pressure and pavement support characteristics, as well as low soluble sulfate content and corrosivity.

#### Subgrade Protection

The near surface soils that are expected to comprise the subgrade are sensitive to water. Unstable soil conditions may develop if the soils are exposed to moisture increases or are disturbed (rutted) by construction traffic. The site should be graded to prevent water from ponding within construction areas and/or flowing into excavations. Accumulated water must be removed immediately along with any unstable soil. Foundation concrete should be placed and excavations backfilled as soon as possible to protect the bearing grade. The degree of subgrade instability and associated remedial construction is dependent, in part, upon precautions taken by the contractor to protect the subgrade during site development.

Silt fences or other appropriate erosion control devices should be installed in accordance with local, state and federal requirements at the perimeter of the development areas to control sediment from erosion. Since silt fences or other erosion control measures are temporary structures, careful and continuous monitoring and periodic maintenance to remove accumulated soil and/or replacement should be anticipated.

#### Fill Placement

All structural fill should be placed in 8-inch-thick maximum loose lifts; moisture conditioned and then compacted in place to at least 90 percent (95% for upper 12 inches of pavement subgrade) of the Modified Proctor maximum density in accordance with the project specifications. A representative of the geotechnical engineer should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.

#### 6.3 <u>Construction Considerations</u>

#### Construction Dewatering

Groundwater was encountered at depths ranging from about 3 to 19.5 feet below grade during our drilling operations and is anticipated to exist both within and below depths of excavations expected for the proposed development. Groundwater rose to about the ground surface in wells installed over a 24 hour period, possibly due to an artesian condition at an estimated depth of about 15 to 20 feet below the existing grade. In the event shallower perched water conditions develop, filtered sump pumps placed in pits in the bottoms of excavations are expected to be suitable if dewatering becomes necessary. A more elaborate dewatering system may however be needed in deep excavations such as in the area of Boring No. 5 which may extend several feet below the water table should an artesian condition develop.

#### Soil Excavation

Some slope stability problems may be encountered in steep, unbraced excavations considering the low-cohesive nature of the subsoils. Slope stability problems should be anticipated for steep unbraced excavations.

All excavations must be performed in accordance with OSHA requirements, which is the responsibility of the contractor. Shallow excavations may be adequately sloped for bank stability while deeper excavations or excavations where adequate back sloping cannot be performed may require some form of external support such as shoring or bracing. Due to the presence of dense soils such as encountered near the surface in Borings No. 4 and 6 and in deep excavations for utilities may require the use of specialized excavation equipment or techniques.

#### 6.4 Foundation Recommendations

#### **Building Foundation System**

Upon completion of the recommended building pad preparation, the proposed structure may be supported by a shallow foundation system underlain by a minimum 2 feet thick structural fill layer. Footings that will support the bearing walls and isolated columns may be designed for a maximum, net, allowable soil-bearing pressure of 3,500 pounds per square foot (psf). Structural loads supported by a mat/slab may also be designed for a 3,500 psf allowable soil bearing pressure and a maximum modulus of subgrade reaction ( $k_s$ ) of 85 pounds per square inch per inch (psi/in.). The maximum allowable bearing capacity is generally controlled by the 10 feet layer of soil with an N-value of 5 encountered in Boring No. 2. Minimum footing widths are recommended to be 18 and 24 inches for walls and columns, respectively, regardless of the calculated soil bearing pressure. The recommended allowable soil bearing pressure may be increased by one-third for short term wind and/or seismic loads.



## Reinforcing

The design of the foundations and the determination of the steel reinforcing should be performed by a qualified structural engineer.

#### Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. Passive pressure and friction may be used in combination, without reduction, in determining the total resistance to lateral loads. A one-third increase in the passive pressure value may be used for short duration wind or seismic loads.

A coefficient of friction of 0.40 may be used with dead load forces for footings placed on newly placed compacted fill soil. An allowable passive earth pressure of 300 psf per foot of footing depth (pcf) below the lowest adjacent grade may be used for the sides of footings placed against newly placed structural fill. The maximum recommended allowable passive pressure is 2,000 psf.

#### **Bearing Material Criteria**

Soil suitable to serve as the structural fill subgrade should exhibit at least a firm relative density (average N value of at least 12) for non-cohesive soils for the recommended allowable soil bearing pressure. For design and construction estimating purposes, suitable bearing soils are expected to be encountered at the recommended over-excavation depths indicated in Section 6.2, Building Pad Preparation. However, field testing by the Geotechnical Engineer within the structural fill supporting soils is recommended to document that the foundation support soils possess the minimum strength parameters noted above. Testing may consist of Dynamic Cone Penetration tests (per ASTM Special Publication 399) or other tests as deemed suitable by the Geotechnical Engineer. If unsuitable bearing soils are encountered, they should be recompacted in-place, if feasible, or excavated to a suitable bearing soil subgrade and to a lateral extent as defined by Item No. 3 of the enclosed Guide Specifications, with the excavation backfilled with structural compacted fill to develop a uniform bearing grade.

#### Foundation Embedment

We recommend that exterior foundations extend at least 18 inches below the adjacent exterior grade or to the minimum embedment requirement by the local agency. Interior footings may be supported at nominal depth below the floor, provided the interior space is continually heated. All footings must be protected against weather and water damage during and after construction, and must be supported within suitable bearing materials.



#### **Estimated Foundation Movement**

Post-construction total and differential settlement of a shallow foundation system designed and constructed in accordance with the recommendations provided in this report are estimated to be less than ¾ and ¼ inch, respectively, for static conditions and interior footings 10 feet on-center. The estimated differential movement is anticipated to result in an angular distortion of less than 0.002 inches per inch on the basis of a minimum clear span of 10 feet. The maximum estimated total and differential movement is considered within tolerable limits for the proposed structure provided it is properly considered in the structural design.

#### 6.5 Floor Slab Recommendations

#### Subgrade

The floor slab subgrade should be prepared in accordance with the appropriate recommendations presented in the <u>Site Development Recommendations</u> section 6.2 of this report and especially Building Pad Preparation. Foundation, utility trenches and other below-slab excavations should be backfilled with structural compacted fill in accordance with the project specifications.

#### Design

The ground floor of the proposed structure may be designed as load-bearing mat/slab based on the recommendations presented in the foundation section of this report. The ground floor may also be design as a conventional slab-on-grade independent of the building foundations. The independent, conventional slab-on-grade may also be designed as a "Mat on Elastic Foundation" using a Modulus of Subgrade Reaction ( $k_s$ ) of 150 pounds per cubic in (pci). The design of the slab is recommended to be performed by the project structural engineer to ensure proper reinforcing and thickness.

The floor slab is recommended to be underlain by a 4-inch thick layer of granular material. A minimum 15-mil synthetic sheet should be placed below the floor slab to serve as a vapor retarder where required to protect moisture sensitive floor coverings (i.e. tile, or carpet, etc.). It is recommended that a structural engineer or architect specify the vapor retarder location with careful consideration of concrete curing and the effects of moisture on future flooring materials. The vapor retarder is recommended to be in accordance with ASTM E 1745-97, which is entitled: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs. If materials underlying the synthetic sheet contain sharp, angular particles, a layer of sand approximately 2 inches thick or a geotextile should be provided to protect it from puncture. An additional 2-inch thick layer of sand may be needed between the slab and the vapor retarder to promote proper curing. Proper curing techniques are recommended to reduce the potential for shrinkage cracking and slab curling.



#### **Estimated Settlement**

With proper site preparation and construction monitoring, the total and differential settlements of a load bearing slab-on-grade, are estimated to be less than  $\frac{3}{4}$  and  $\frac{1}{4}$  inches across a 10 foot span, respectively. Therefore, settlements are on the order of the estimates for the building perimeter foundation where the slab and perimeter footings are combining as one structural foundation unit.

#### 6.6 Pavement Recommendations

The following recommendations for the new pavement are intended for vehicular traffic associated with the new building development and are not intended for use throughout the existing facility.

#### Subgrades for New Pavement

Following completion of the recommended subgrade preparation procedures, the pavement subgrade soils are expected to consist of silty sand with some gravel. The anticipated subgrade soils are classified as good to excellent subgrade materials with estimated CBR values ranging from 10 to 20 when properly prepared based on the Unified Soil Classification System designation of SM. An estimated CBR value of 10 has been used in the preparation of the pavement design based on the silty sand soils. It should, however, be recognized that the City of Bellevue/King County may require a specific CBR value test to verify the use of the following design. It is recommended that this testing be conducted following completion of rough grading in the proposed pavement areas so that the CBR value test results are indicative of the actual pavement subgrade soils. Alternatively, a minimum code pavement section may be required if a specific CBR value test is not performed. To use this CBR value, all fill added to the pavement subgrade must have pavement support characteristics at least equivalent to the existing soils, and must be placed and compacted in accordance with the project specifications.

#### **Asphalt Pavements**

The following table represents the recommended thicknesses for new asphaltic concrete pavement with the appropriate state highway specifications so that the proper materials and construction procedures are used. Considering the high quality of the subgrade soils, a full depth pavement section is considered the most economical. However, local codes may require specific testing to determine the soil support characteristics and/or minimum pavement section thicknesses. A parking stall pavement section has also been presented. However, if truck traffic cannot be excluded from the parking stalls, the drive lane pavement section should be used or a reduced service life (premature failure) may occur.



ASPHALT PAVEMENTS				
Materials	Thickness (inches)		Washington DOT Standard	
	Parking Stalls	Drive Lanes	Specifications	
Asphaltic Concrete Surface Course (b)	1	1	Section 5-04 (a)	
Asphaltic Concrete Binder Course (b)	2	2	Section 5-04 (a)	
Aggregate Base Course	4	6	Section 4-04 (Base Course)	

NOTES:

(a) Compaction to density between 95 and 100 percent of the 50-Blow Marshall Density

(b) The surface and binder course may be combined as a single layer placed in one lift if similar materials are utilized.

Pavement recommendations are based upon design parameters for a twenty-year design period and assume proper drainage and construction observation and testing. It is, therefore, recommended that the geotechnical engineer observes and tests subgrade preparation, and that the subgrade be evaluated immediately before pavement construction. Pavement rehabilitation at 7- to 8-year intervals should be expected to achieve a twenty-year service life.

#### Concrete Pavement

Portland cement concrete pavement is recommended for areas of new pavement that will be subjected to channelized traffic, large loads or intense vehicular stresses such as the drive-thru lane, trash enclosure loading zone and the entrance/exit aprons. In such areas, a 6-inch thick, properly reinforced concrete pavement is recommended. The concrete pavement is recommended to be underlain by a 4-inch compacted coarse granular base placed on a properly prepared subgrade. The use of concrete pavement is also recommended within the entrance/exit aprons to the parking lot and the drive-thru lane. Minimum reinforcement within concrete pavements is recommended to consist of heavy welded wire fabric (6 X 6-W2.9 X W2.9 WWF), placed at mid-slab height. The materials and construction procedures should be in accordance with the Washington DOT Standard Specifications Section 5-05 for concrete and Section 4-04 for base course.

#### **General Considerations**

Pavement designs are based on AASHTO design parameters. It is, therefore, recommended that a representative of the geotechnical engineer observes and test subgrade preparation, and that the subgrade be evaluated immediately before pavement construction. These designs are also based on a routine pavement maintenance program and significant asphaltic concrete pavement rehabilitation after about 8 to 10 years to obtain the anticipated pavement service life.



#### Basis of Report

This report has been based on the project description given earlier in this report. *Giles* must be notified if any part of the project description is not accurate so that this report can be amended, if needed. This report is based on the assumption that the proposed development will be designed and constructed according to the codes that govern construction at the site.

The conclusions and recommendations in this report are based on estimated subsurface conditions as shown on the *Records of Subsurface Exploration*. Giles must be notified if the subsurface conditions that are encountered during construction of the proposed development differ from those shown on the *Records of Subsurface Exploration* because this report will likely need to be revised. General comments and limitations of this report are given in the appendix.

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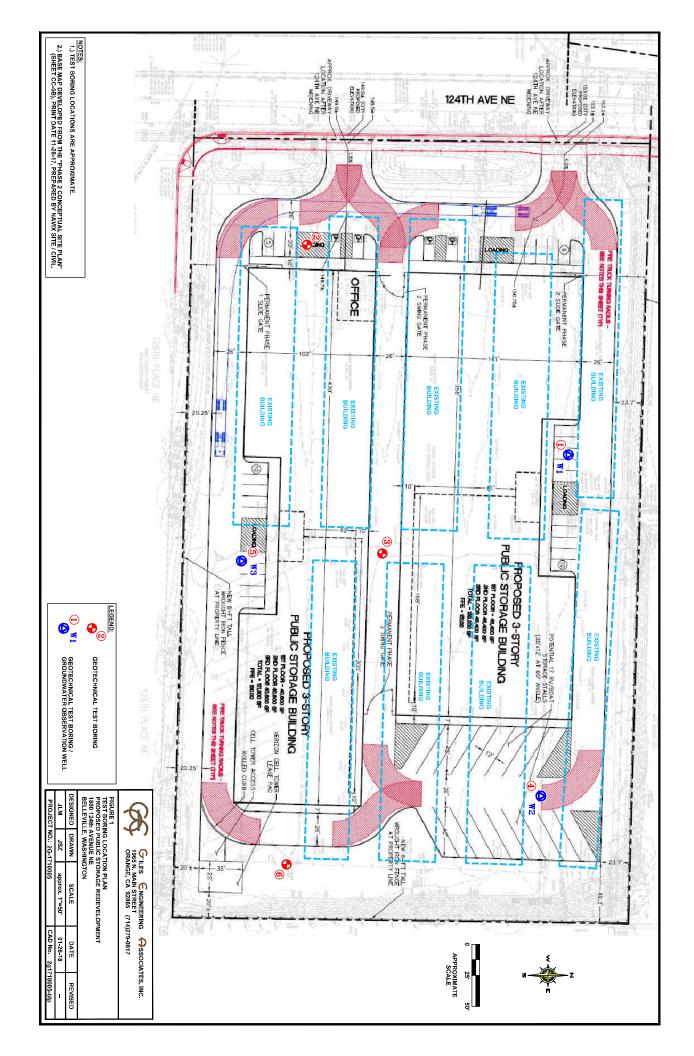


#### APPENDIX A

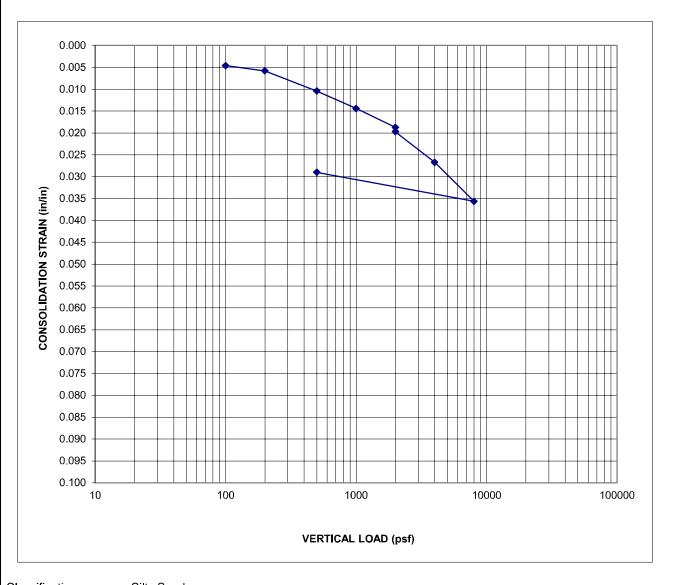
## FIGURES AND TEST BORING LOGS

The Test Boring Location Plan contained herein was prepared based upon information supplied by *Giles'* client, or others, along with *Giles'* field measurements and observations. The diagram is presented for conceptual purposes only and is intended to assist the reader in report interpretation.

The Test Boring Logs and related information enclosed herein depict the subsurface (soil and water) conditions encountered at the specific boring locations on the date that the exploration was performed. Subsurface conditions may differ between boring locations and within areas of the site that were not explored with test borings. The subsurface conditions may also change at the boring locations over the passage of time.



## **COLLAPSE TEST ASTM D5333**



Classification Silt	y Sand		
Boring No.	B-3		
Sample No.	3-CS	Initial Moisture Content (%)	12.7
Depth (ft.)	6.0 - 7.5	Final Moisture Content (%)	11.3
Elevation		Natural Density (pcf)	138.0
Liquid Limit		Initial Dry Density (pcf)	122.5
Plastic Limit		Final Dry Density (pcf)	126.1
Specimen Diameter (in.)	2.42	Collapse at 2000 psf	0.10%
Initial Specimen Thickness	(in.) 1.00		

Sample inundated at 2000 psf pressure

Project: PS Bellevue

Client: Public Storage, Inc.

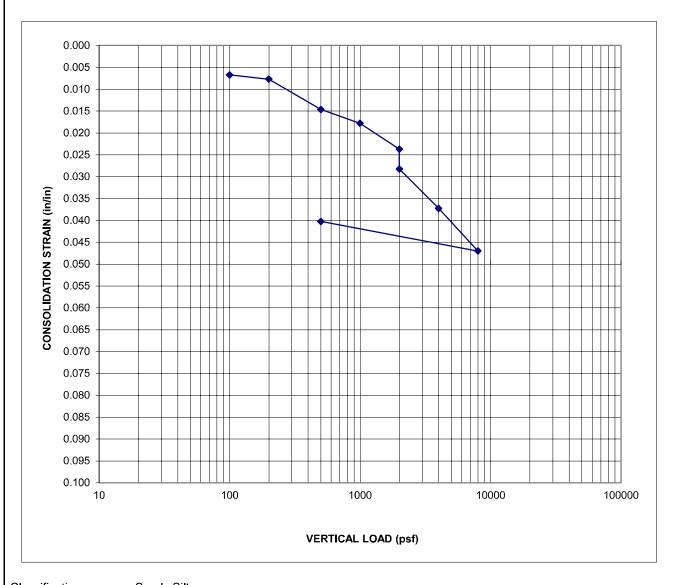
Project No.: 2G-1710005

Figure No.: 2

## GILES ENGINEERING ASSOCIATES, INC.

-GEOTECHNICAL, ENVIRONMENTAL, AND CONSTRUCTION MATERIALS1965 NORTH MAIN STREET, ORANGE, CALIFORNIA
OFFICE: 714-279-0817 FAX: 714-279-9687

## **COLLAPSE TEST ASTM D5333**



Classification S	andy Silt		
Boring No.	B-5		
Sample No.	3-CS	Initial Moisture Content (%)	10.3
Depth (ft.)	6.0 - 7.5	Final Moisture Content (%)	9.9
Elevation		Natural Density (pcf)	136.1
Liquid Limit		Initial Dry Density (pcf)	123.4
Plastic Limit		Final Dry Density (pcf)	128.6
Specimen Diameter (in.)	2.42	Collapse at 2000 psf	0.45%
Initial Specimen Thicknes	ss (in.) 1.00		

Sample inundated at 2000 psf pressure

Project: PS Bellevue

Client: Public Storage, Inc.

Project No.: 2G-1710005

Figure No.: 3

## GILES ENGINEERING ASSOCIATES, INC.

-GEOTECHNICAL, ENVIRONMENTAL, AND CONSTRUCTION MATERIALS-1965 NORTH MAIN STREET, ORANGE, CALIFORNIA OFFICE: 714-279-0817 FAX: 714-279-9687

# BORING NO. & LOCATION: SURFACE ELEVATION: 151 feet COMPLETION DATE: 11/30/17 FIELD REP: TREVOR SLAZAS

# **TEST BORING LOG**

PROPOSED PUBLIC STORAGE REDEVELOPMENT

1800 124TH AVENUE NE BELLEVUE, WA



GILES ENGINEERING ASSOCIATES, INC.

PROJECT NO: 2G-1710005

MATERIAL DESCRIPTION		Depth (ft)	Elevation	Sample No. & Type	N	Q. (tsf)	Q, (tsf)	Q, (tsf)	W (%)	PID	NOTES
Approximately 3 inches of asphaltic concrete over 2 inches of aggregate base			<b>—</b> 150	1-SS	14						
Gray Silty fine Sand, little Gravel - Moist (Possible Fill)		-	-	1-00	14				8		
Brown fine to coarse Sand, trace to little Silt, some Gravel - Very Moist to Wet (Possible Native)		5 <b>—</b>	- 115	2-CS	29				14		
Light Brown fine Sandy Silt - Very Moist to Wet (Native)		1	<b>-</b> 145 - -	3-CS	28				19		
		10-	- 140 	4-SS	49				16		
Gray fine to coarse Sand with Gravel, trace to ittle Silt, possible Cobbles and Boulders -	00.00	15	- - - 135 - -	5-SS	50/1"				11		
	00 00 00 00 00 00 00 00 00 00 00 00 00	20	- - 130	6-SS	64				10		j
to S<	09.	25	125	7-SS ,	50/5"				9		
	10	+									

✓ Water Encountered During Drilling:  CS = California Split Spoon  ✓ Water Level At End of Drilling:		Water Observation Data	Demostra
Water Level At End of Drilling:			Remarks:
Water Level At End of Drilling:  SS = Standard Banatarilla Tanà	Ā	Water Encountered During Drilling:	CS = California Split Spoon
			SS = Standard Penetration Test
		Cave Depth At End of Drilling:	SS = Standard Penetration Test

#### BORING NO. & LOCATION: **TEST BORING LOG** B-2 SURFACE ELEVATION: PROPOSED PUBLIC STORAGE REDEVELOPMENT 147 feet COMPLETION DATE: 1800 124TH AVENUE NE 11/29/17 BELLEVUE, WA GILES ENGINEERING ASSOCIATES, INC. FIELD REP: TREVOR SLAZAS PROJECT NO: 2G-1710005 Sample No. & Type £ Elevation Q, $Q_p$ Q, W MATERIAL DESCRIPTION Depth ( N PID (tsf) (tsf) (tsf) (%) Approximately 2 inches of asphaltic concrete Grayish-Brown Silty fine Sand, little Gravel -1-SS 17 14 Moist (possible Fill) 145 Gray fine Sandy Silt, little Gravel - Moist 2-SS 13 15 (Possible Native) Brown Silty fine Sand, trace to little Clay -**3-SS** 5 17 Very Moist (native) 140 10 Brown fine Sandy Silt - Wet **4-SS** 5 39 135 15 5-SS 13 17 130 20 6-SS 40 15 125 25 Gray Silty fine to coarse Sand, some Grayel. **7-SS** 64 11 possible Cobbles and Boulders - Moist

NOTES

Groundwater encountered at 16.5 feet Boring Terminated at about 26.5 feet (EL. 120.5')

GILES.GDT

GILES LOG REPORT 2G-1710005 GPJ

	Water Observation Data	Remarks:
$\nabla$	Water Encountered During Drilling: 16.5 ft.	SS = Standard Penetration Test
A	Water Level At End of Drilling:	and a contract of the second and the
00.000	Cave Depth At End of Drilling:	
<u>*</u>	Water Level After Drilling:	
-	Cave Depth After Drilling:	

#### BORING NO. & LOCATION: **TEST BORING LOG** B-3 SURFACE ELEVATION: PROPOSED PUBLIC STORAGE REDEVELOPMENT 148 feet COMPLETION DATE: 1800 124TH AVENUE NE 11/29/17 BELLEVUE, WA GILES ENGINEERING ASSOCIATES, INC. FIELD REP: TREVOR SLAZAS PROJECT NO: 2G-1710005 Sample No. & Type Elevation Depth (ft) Q, Q, Q. W MATERIAL DESCRIPTION N (tsf) (tsf) (tsf) (%) Approximately 2.5 inches of asphaltic concrete over 1 inch of aggregate base 1-SS 29 11 Gray Silty fine to coarse Sand, little Gravel -Moist (Fill) 2-SS 4 50 Brown fine Sandy Silt, little Clay, some ¥ organic materials- Very Moist (Possible Fill) 3-CS 13 16 140 Light Brown Silty fine Sand to Sandy Silt, little Gravel - Moist to Very Moist (Native) 10 4-CS 28 Brown Silty fine to coarse Sand with Gravel, 5-SS 50/3" 9 possible Cobbles and Boulders - Wet o 130 0 0 20 **6-SS** 64 15 o 0

Brown fine to coarse Sand and Gravel,

possible Cobbles and Boulders - Wet

Groundwater encountered at 6.5 feet

Water Level At End of Drilling:

Cave Depth At End of Drilling:

Water Level After Drilling: Cave Depth After Drilling:

GILES.GDT

2G-1710006.GPJ

GILES LOG REPORT

V

Y

Y

11-SS 50/5" Boring Terminated at about 46 feet (EL. 102') Water Observation Data Remarks: Water Encountered During Drilling: 6.5 ft. CS = California Split Spoon SS = Standard Penetration Test Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

PID

9

7

8

11

NOTES

LL=21 PL=17

PI=4

**7-SS** 

8-SS

9-SS

**10-SS** 

120

110

30

40

50/6"

50/2"

50/5"

50/5"

#### BORING NO. & LOCATION: **TEST BORING LOG** B-4 SURFACE ELEVATION: PROPOSED PUBLIC STORAGE REDEVELOPMENT 153 feet COMPLETION DATE: 1800 124TH AVENUE NE 11/30/17 BELLEVUE, WA **GILES ENGINEERING** ASSOCIATES, INC. FIELD REP: TREVOR SLAZAS PROJECT NO: 2G-1710005 Sample No. & Type Depth (ft) Elevation Q, Q, Q, W MATERIAL DESCRIPTION N PID (tsf) (tsf) (tsf) (%) Approximately 4 inches of asphaltic concrete over 5 inches of aggregate base Brownish-Gray fine Sandy Silt, some Clay, little Gravel - Moist (Possible Native) 1-SS 52 17 150 2-SS 56 14 Gray Silty fine to coarse Sand, Some Gravel, **3-SS** 50/5" 11 possible Cobbles and Boulders - Moist 0 [ 0 145 0 0 0 **4-SS** 50/4° 9 C 0 0 140 15 Gray fine to coarse Sand and Gravel, trace to **5-SS** 50/5" 9 little Silt, possible Cobbles and Boulders -Moist 135 20 6-SS 50/4" 10

NOTES

Groundwater encountered at 12.5 feet Boring Terminated at about 21.5 feet (EL. 131.5')

GILES LOG REPORT 2G-1710005.GPJ GILES.GDT

200	Water Observation Data	Remarks:	
Ž	Water Encountered During Drilling: None	SS = Standard Penetration Test	
ā	Water Level At End of Drilling:		
100	Cave Depth At End of Drilling:		
1	Water Level After Drilling:		- 1
	Cave Depth After Drilling:		

# BORING NO. & LOCATION: SURFACE ELEVATION: 150 feet COMPLETION DATE: 11/30/17 FIELD REP: TREVOR SLAZAS

# **TEST BORING LOG**

PROPOSED PUBLIC STORAGE REDEVELOPMENT

1800 124TH AVENUE NE

BELLEVUE, WA



GILES ENGINEERING ASSOCIATES, INC.

PROJECT NO: 2G-1710005

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q <sub>u</sub> (tsf)	Q <sub>p</sub> (tsf)	Q, (tsf)	W (%)	PID	NOTES
Approximately 2 inches of asphaltic concrete over 2 inches of aggregate base										
Gray Silty fine Sand, little Gravel - Moist (Possible Fill)	-		1-SS	6				10		
	5—		2-CS	4				14		
	_		3-CS	4				11		
Light Gray fine Sandy Sill - Very Moist Wet (Native)		-								
	10-	- 140 - -	4-SS	13				15		
Gray Silty fine Sand - Very Moist to Wet	15	- 135 -	5-SS	28				13		
	1	-								
Gray fine to coarse Sand and Gravel, little Silt, possible Cobbles - Moist	20	- 130	6-SS	41				16		
	25	- 125 -	7-SS	50/5"						

Bo	oundwater encountered at 3 feet ring Terminated at about 26.5 feet (EL. 3.5')	7-SS 50/5" 7
	Water Observation Data	Remarks:
▲ Ā Ā	Water Encountered During Drilling: Water Level At End of Drilling: Cave Depth At End of Drilling: Water Level After Hours: 3 ft.	CS = California Split Spoon SS = Standard Penetration Test
	vvater Level After Hours: 3 ff	E.

## BORING NO. & LOCATION: **TEST BORING LOG** B-6 SURFACE ELEVATION: PROPOSED PUBLIC STORAGE REDEVELOPMENT 142 feet COMPLETION DATE: 1800 124TH AVENUE NE 11/29/17 BELLEVUE, WA **GILES ENGINEERING** ASSOCIATES, INC. FIELD REP: TREVOR SLAZAS PROJECT NO: 2G-1710005 Sample No. & Type Elevation Depth (ft) Q, Q, Q, W MATERIAL DESCRIPTION N PID (tsf) (tsf) (tsf) (%) Approximately 1.5 inches of asphaltic concrete Gray fine Sandy Silt, some Clay, Some Gravel - Moist (Possible Native) 1-SS 63 13 140.0 2.5 Light Brown Silty fine to coarse Sand, some Gravel, possible Cobbles - Moist 0 2-SS 50/3" 14 0 0 137 5.0 o. 0 0 0 0

0 ø NOTES

No groundwater encountered Boring Terminated at about 7.5 feet (EL. 134.5')

005.GPJ GILES.GDT

5	Water Observation Data	Remarks:
¥	Water Encountered During Drilling: None	SS = Standard Penetration Test
Ā	Water Level At End of Drilling:	
\$X35.5	Cave Depth At End of Drilling:	10
¥	Water Level After Drilling:	
	Cave Depth After Drilling:	

**3-SS** 

135.

50/3"

12

## **APPENDIX B**

## FIELD PROCEDURES

The field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) designation D

420 entitled "Standard Guide for Sampling Rock and Rock" and/or other relevant specifications. Soil samples were preserved and transported to *Giles*' laboratory in general accordance with the procedures recommended by ASTM designation D 4220 entitled "Standard Practice for Preserving and Transporting Soil Samples." Brief descriptions of the sampling, testing and field procedures commonly performed by *Giles* are provided herein.

## GENERAL FIELD PROCEDURES

## Test Boring Elevations

The ground surface elevations reported on the Test Boring Logs are referenced to the assumed benchmark shown on the Boring Location Plan (Figure 1). Unless otherwise noted, the elevations were determined with a conventional hand-level and are accurate to within about 1 foot

## **Test Boring Locations**

The test borings were located on-site based on the existing site features and/or apparent property lines. Dimensions illustrating the approximate boring locations are reported on the Boring Location Plan (Figure 1).

## Water Level Measurement

The water levels reported on the Test Boring Logs represent the depth of "free" water encountered during drilling and/or after the drilling tools were removed from the borehole. Water levels measured within a granular (sand and gravel) soil profile are typically indicative of the water table elevation. It is usually not possible to accurately identify the water table elevation with cohesive (clayey) soils, since the rate of seepage is slow. The water table elevation within cohesive soils must therefore be determined over a period of time with groundwater observation wells.

It must be recognized that the water table may fluctuate seasonally and during periods of heavy precipitation. Depending on the subsurface conditions, water may also become perched above the water table, especially during wet periods.

## **Borehole Backfilling Procedures**

Each borehole was backfilled upon completion of the field operations. If potential contamination was encountered, and/or if required by state or local regulations, boreholes were backfilled with an "impervious" material (such as bentonite slurry). Borings that penetrated pavements, sidewalks, etc. were "capped" with Portland Cement concrete, asphaltic concrete, or a similar surface material. It must, however, be recognized that the backfill material may settle, and the surface cap may subside, over a period of time. Further backfilling and/or re-surfacing by *Giles'* client or the property owner may be required.



## FIELD SAMPLING AND TESTING PROCEDURES

## Auger Sampling (AU)

Soil samples are removed from the auger flights as an auger is withdrawn above the ground surface. Such samples are used to determine general soil types and identify approximate soil stratifications. Auger samples are highly disturbed and are therefore not typically used for geotechnical strength testing.

## Split-Barrel Sampling (SS) – (ASTM D-1586)

A split-barrel sampler with a 2-inch outside diameter is driven into the subsoil with a 140-pound hammer free-falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the "Standard Penetration Resistance" or N-value is an index of the relative density of granular soils and the comparative consistency of cohesive soils. A soil sample is collected from each SPT interval.

## Shelby Tube Sampling (ST) – (ASTM D-1587)

A relatively undisturbed soil sample is collected by hydraulically advancing a thin-walled Shelby Tube sampler into a soil mass. Shelby Tubes have a sharp cutting edge and are commonly 2 to 5 inches in diameter.

## Bulk Sample (BS)

A relatively large volume of soils is collected with a shovel or other manually-operated tool. The sample is typically transported to *Giles*' materials laboratory in a sealed bag or bucket.

## Dynamic Cone Penetration Test (DC) – (ASTM STP 399)

This test is conducted by driving a 1.5-inch-diameter cone into the subsoil using a 15-pound steel ring (hammer), free-falling a vertical distance of 20 inches. The number of hammer-blows required to drive the cone 1¾ inches is an indication of the soil strength and density, and is defined as "N". The Dynamic Cone Penetration test is commonly conducted in hand auger borings, test pits and within excavated trenches.

- Continued -



## Ring-Lined Barrel Sampling - (ASTM D 3550)

In this procedure, a ring-lined barrel sampler is used to collect soil samples for classification and laboratory testing. This method provides samples that fit directly into laboratory test instruments without additional handling/disturbance.

## Sampling and Testing Procedures

The field testing and sampling operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the field testing (i.e. N-values) are reported on the Test Boring Logs. Explanations of the terms and symbols shown on the logs are provided on the appendix enclosure entitled "General Notes".



## **APPENDIX C**

## LABORATORY TESTING AND CLASSIFICATION

The laboratory testing was conducted under the supervision of a geotechnical engineer in accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Brief descriptions of laboratory tests commonly performed by *Giles* are provided herein.

## LABORATORY TESTING AND CLASSIFICATION

## Photoionization Detector (PID)

In this procedure, soil samples are "scanned" in *Giles'* analytical laboratory using a Photoionization Detector (PID). The instrument is equipped with an 11.7 eV lamp calibrated to a Benzene Standard and is capable of detecting a minute concentration of **certain** Volatile Organic Compound (VOC) vapors, such as those commonly associated with petroleum products and some solvents. Results of the PID analysis are expressed in HNu (manufacturer's) units rather than actual concentration.

## Moisture Content (w) (ASTM D 2216)

Moisture content is defined as the ratio of the weight of water contained within a soil sample to the weight of the dry solids within the sample. Moisture content is expressed as a percentage.

## Unconfined Compressive Strength (qu) (ASTM D 2166)

An axial load is applied at a uniform rate to a cylindrical soil sample. The unconfined compressive strength is the maximum stress obtained or the stress when 15% axial strain is reached, whichever occurs first.

## Calibrated Penetrometer Resistance (qp)

The small, cylindrical tip of a hand-held penetrometer is pressed into a soil sample to a prescribed depth to measure the soils capacity to resist penetration. This test is used to evaluate unconfined compressive strength.

## Vane-Shear Strength (qs)

The blades of a vane are inserted into the flat surface of a soil sample and the vane is rotated until failure occurs. The maximum shear resistance measured immediately prior to failure is taken as the vane-shear strength.

## Loss-on-Ignition (ASTM D 2974; Method C)

The Loss-on-Ignition (L.O.I.) test is used to determine the organic content of a soil sample. The procedure is conducted by heating a dry soil sample to 440°C in order to burn-off or "ash" organic matter present within the sample. The L.O.I. value is the ratio of the weight loss due to ignition compared to the initial weight of the dry sample. L.O.I. is expressed as a percentage.



## Particle Size Distribution (ASTB D 421, D 422, and D 1140)

This test is performed to determine the distribution of specific particle sizes (diameters) within a soil sample. The distribution of coarse-grained soil particles (sand and gravel) is determined from a "sieve analysis," which is conducted by passing the sample through a series of nested sieves. The distribution of fine-grained soil particles (silt and clay) is determined from a "hydrometer analysis" which is based on the sedimentation of particles suspended in water.

## Consolidation Test (ASTM D 2435)

In this procedure, a series of cumulative vertical loads are applied to a small, laterally confined soil sample. During each load increment, vertical compression (consolidation) of the sample is measured over a period of time. Results of this test are used to estimate settlement and time rate of settlement.

## Classification of Samples

Each soil sample was visually-manually classified, based on texture and plasticity, in general accordance with the Unified Soil Classification System (ASTM D-2488-75). The classifications are reported on the Test Boring Logs.

## <u>Laboratory Testing</u>

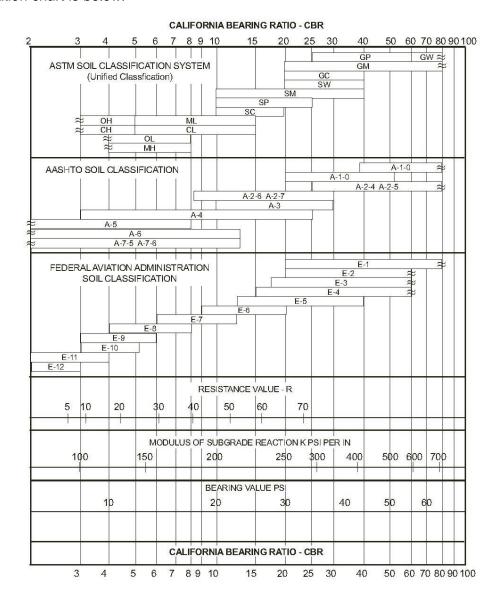
The laboratory testing operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the laboratory tests are provided on the Test Boring Logs or other appendix enclosures. Explanation of the terms and symbols used on the logs is provided on the appendix enclosure entitled "General Notes."



## California Bearing Ratio (CBR) Test ASTM D-1833

The CBR test is used for evaluation of a soil subgrade for pavement design. The test consists of measuring the force required for a 3-square-inch cylindrical piston to penetrate 0.1 or 0.2 inch into a compacted soil sample. The result is expressed as a percent of force required to penetrate a standard compacted crushed stone.

Unless a CBR test has been specifically requested by the client, the CBR is estimated from published charts, based on soil classification and strength characteristics. A typical correlation chart is below.





## **APPENDIX D**

## **GENERAL INFORMATION**

## GUIDE SPECIFICATIONS FOR SUBGRADE AND PREPARATION FOR FILL, FOUNDATION, FLOOR SLAB AND PAVEMENT SUPPORT; AND SELECTION, PLACEMENT AND COMPACTION OF FILL SOILS USING MODIFIED PROCTOR PROCEDURES

- Construction monitoring and testing of subgrades and grades for fill, foundation, floor slab and pavement; and fill selection, placement and compaction shall be performed by an experienced soils engineer and/or his representatives.
- 2. All compacted fill, subgrades, and grades shall be (a) underlain by suitable bearing material, (b) free of all organic frozen, or other deleterious material, and (c) observed, tested and approved by qualified engineering personnel representing an experienced soils engineer. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of (a) proofrolling to detect soft, wet, yielding soils or other unstable materials that must be undercut, (b) scarifying top 6 to 8 inches, (c) moisture conditioning the soils as required, and (d) recompaction to same minimum in-situ density required for similar material indicated under Item 5. Note: Compaction requirements for pavement subgrade are higher than other areas. Weather and construction equipment may damage compacted fill surface and reworking and retesting may be necessary for proper performance.
- 3. In overexcavation and fill areas, the compacted fill must extend (a) a minimum 1 foot lateral distance beyond the exterior edge of the foundation at bearing grade or pavement at subgrade and down to compacted fill subgrade on a maximum 0.5(H):1(v) slope, (b) 1 foot above footing grade outside the building, and (c) to floor subgrade inside the building. Fill shall be placed and compacted on a 5(H):1(V) slope or must be stepped or benched as required to flatten if not specifically approved by qualified personnel under the direction of an experienced soils engineer.
- 4. The compacted fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated", and shall be low-expansive with a maximum Liquid Limit (ASTM D-423) and Plasticity Index (ASTM D-424) of 30 and 15, respectively, unless specifically tested and found to have low expansive properties and approved by an experienced soils engineer. The top 12 inches of compacted fill should have a maximum 3 inch particle diameter and all underlying compacted fill a maximum 6 inch diameter unless specifically approved by an experienced soils engineer. All fill material must be tested and approved under the direction of an experienced soils engineer prior to placement. If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per Unified Soils Classification System (ASTM D-2487).
- 5. For structural fill depths less than 20 feet, the density of the structural compacted fill and scarified subgrade and grades shall not be less than 90 percent of the maximum dry density as determined by Modified Proctor (ASTM D-1557) with the exception of the top 12 inches of pavement subgrade which shall have a minimum in-situ density of 95 percent of maximum dry density, or 5 percent higher than underlying structural fill materials. Where the structural fill depth is greater than 20 feet, the portion below 20 feet should have a minimum in-place density of 95 percent of its maximum dry density or 5 percent higher than the top 20 feet. Cohesive soils shall not vary by more than -1 to +3 percent moisture content and granular soil ±3 percent from the optimum when placed and compacted or recompacted, unless specifically recommended/approved by the soils engineer observing the placement and compaction. Cohesive soils with moderate to high expansion potentials (PI>15) should, however, be placed, compacted and maintained prior to construction at a 3±1 percent moisture content above optimum moisture content to limit future heave. Fill shall be placed in layers with a maximum loose thickness of 8 inches for foundations and 10 inches for floor slabs and pavements, unless specifically approved by the soils engineer taking into consideration the type of materials and compaction equipment being used. The compaction equipment should consist of suitable mechanical equipment specifically designed for soil compaction. Bulldozers or similar tracked vehicles are typically not suitable for compaction.
- 6. Excavation, filing, subgrade grade preparation shall be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working platform. Springs or water seepage encountered during grade/foundation construction must be called to the soils engineer's attention immediately for possible construction procedure revision or inclusion of an underdrain system.
- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls (i.e. basement walls and retaining walls) must be properly tested and approved by an experienced soils engineer with consideration for the lateral pressure used in the wall design.
- 8. Wherever, in the opinion of the soils engineer or the Owner's Representatives, an unstable condition is being created either by cutting or filling, the work should not proceed into that area until an appropriate geotechnical exploration and analysis has been performed and the grading plan revised, if found necessary.



## **GENERAL COMMENTS**

The soil samples obtained during the subsurface exploration will be retained for a period of thirty days. If no instructions are received, they will be disposed of at that time.

This report has been prepared exclusively for the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. Copies of this report may be provided to contractor(s), with contract documents, to disclose information relative to this project. The report, however, has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project architect, structural engineer, and/or civil engineer. Reproduction and distribution of this report must be authorized by the client and *Giles*.

This report has been based on assumed conditions/characteristics of the proposed development where specific information was not available. It is recommended that the architect, civil engineer and structural engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. The project plans and specifications may also be submitted to *Giles* for review to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted.

The analysis of this site was based on a subsoil profile interpolated from a limited subsurface exploration. If the actual conditions encountered during construction vary from those indicated by the borings, *Giles* must be contacted immediately to determine if the conditions alter the recommendations contained herein.

The conclusions and recommendations presented in this report have been promulgated in accordance with generally accepted professional engineering practices in the field of geotechnical engineering. No other warranty is either expressed or implied.



	suitable			used	dramage				
Not suitable		Not suitable	Not suitable	ld not be	Fair to poor	Very high		Not suitable	Pt
Not suitable	Not I	Not suitable	Very poor	Unstable, should not be used	No drainage, impervious	High	65-100	Fair to poor: sheepsfoot roller	ОН
Not suitable	Very poor	Not suitable	ry	Fair stability, may soften on expansion	No drainage, impervious	Very high	80-105	Fair to poor: sheepsfoot roller	СН
Not suitable		Not suitable	Poor	,	Poor drainage, impervious	High	70-95	Fair to poor: sheepsfoot or rubber- tired roller	МН
Not suitable	Not suitable 1	Not suitable	Poor	Unstable, should not be used	Poor drainage, impervious	Medium to high	80-100	Fair to poor: sheepsfoot or rubber- tired roller	OL
Poor	Poor	Not suitable	Fair to poor	bility	No drainage, impervious	Medium	95-120	Good to fair: sheepsfoot or rubber- tired roller	CL
Poor	Poor	Not suitable	Fair to poor	Poor stability, high density required	Poor drainage, impervious	Slight to medium	95-120	Good to poor: rubber-tired or sheepsfoot roller	ML
Excellent	Excellent	Fair to poor	Good to fair	nably	Poor drainage, impervious	Slight to medium	105-125	Good to fair: rubber-tired or sheepsfoot roller	SC
Poor to fair	Poor	Poor	Good to fair	Reasonably stable when dense	Poor drainage, impervious	Slight	110-125	Good: rubber-tired or sheepsfoot roller	SM
Poor to fair		Poor	Good to fair	Reasonably stable when dense	Good drainage, pervious	Almost none	100-120	Good: tractor, rubber-tired or vibratory roller	SP
Good	Fair to (	Fair to poor	Good	Very stable	Good drainage, pervious	Almost none	110-130	Good: tractor, rubber-tired or vibratory roller	SW
Excellent	Excellent	Good to fair **	Good	Reasonably stable	Poor drainage, impervious	Slight	115-130	Good to fair: rubber-tired or sheepsfoot roller	GC
Poor to fair	Poor	Fair to poor	Excellent to good	Reasonably stable	Poor drainage, semipervious	Slight	120-135	Good: rubber-tired or light sheepsfoot roller	GM
	Poor	Poor to fair	Excellent to good	Reasonably stable	Good drainage, pervious	Almost none	115-125	Good: tractor, rubber-tired, steel wheel or vibratory roller	GP
Excellent	Fair to I	Good	Excellent	Very stable	Good drainage, pervious	Almost none	125-135	Good: tractor, rubber-tired, steel wheel or vibratory roller	GW
emporary ment With Bituminous Treatment	Value as Temporary Pavement With Dust Palliative Treatme	Value as Base Course	Value as Subgrade When Not Subject to Frost	Value as an Embankment Material	Drainage and Permeability	Compressibility and Expansion	Max. Dry Density Standard Proctor (pcf)	Compaction Characteristics	Class
		OIL CONSTRUCTION *	R SOIL CONS	M CLASSES FOR	FIED SOIL SYSTE	CHARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SO	TICS AND	CHARACTERIS	

<sup>&</sup>quot;The Unified Classification: Appendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments and Foundations," Technical Memorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

<sup>\*\*</sup> Not suitable if subject to frost.



## UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Ма	ajor Divis	ions	Gro Symb		Typical Names				Labo	ratory	Classi	ificat	ion Cri	teria		
	s larger	Clean gravels (little or no fines)	G۷	V	Well-graded gravels, gravel-sand mixtures, little or no fines		arse-	mbols <sup>b</sup>	C <sub>u</sub> =	= D <sub>60</sub> D <sub>10</sub> gre	eater th	nan 4;	$C_c = \frac{(D_1)}{D_{10}}$	o D <sub>60</sub> be	tween	1 and 3
ize)	fraction i e size)	Clean g (little fin	GF	)	Poorly graded gravels, gravel-sand mixtrues, little or no fines	curve.	/e size), cc	ng dual sy	١	lot mee	ting al	l grad	ation re	quirem	ents fo	r GW
Coarse-grained soils (more than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Gravels with fines (appreciable amount of fines)	GMª -	d u	Silty gravels, gravel- sand-silt mixtures	Determine percentages of sand and gravel from grain-size curve.	Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarsegending on percents are classified as follows:  Less than 5 percent:  GW, GP, SW, SP	GM, GC, SM, SC Borderline cases requiring dual symbols <sup>b</sup>		terberg ow "A" li less tha	ne or P.	.l.   L			″line w and 7 a	ith P.I. re
Coarse-grained soils naterial is larger thar	(More th	Grave (apprecia	GC	-	Clayey gravels, gravel- sand-clay mixtures	and grave	age of fines (fraction smaller than No. grained soils are classified as follows: 5 percent:	GM, GC Borderl	abo	terberg ve "A" li reater t	ne or P.	l.		of dual		
Coarse-gr material is	ion is e)	Clean sands (Little or no fines)	SW	/	Well-graded sands, gravelly sands, little or no fines	es of sand	nes (fracti   soils are c ent:	rcent:	<b>C</b> <sub>u</sub> =	D <sub>60</sub> gre	ater th	an 4; (	$C_c = \frac{(D_s)}{D_{10}}$	<sub>30</sub> )² ( D <sub>60</sub> be	etween	1 and 3
in half of i	arse fract 4 sieve siz	Clean (Little fin	SP	)	Poorly graded sands, gravelly sands, little or no fines	percentag	n percentage of fines grained soi Less than 5 percent:	More than 12 percent: 5 to 12 percent:		Not me	eting al	<b>II</b> grad	ation re	quirem	ents fo	r SW
(more tha	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Sands with fines (Appreciable amount of fines)	SMª -	d u	Silty sands, sand-silt mixtures	Determine p	nding on percei Less tha	More the 5 to 12		terberg ow "A" li less tha	ne or P.	.l.			"line w and 7 a	th P.I. re
	(More	Sand (Apprec	SC	-	Clayey sands, sand-clay mixtures	ď	Depe		abo	terberg ve "A" li reater t	ne or P.	ıl.		of dual		
size)	ays	than 50)	MI	-	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	601					Plasticity Chart					
Vo. 200 sieve size)	Silts and clays	(Liquid limit less than 50)	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays	50							СН			
d soils ler than N		(Liq	OL	-	Organic silts and organic silty clays of low plasticity	anic silts and hic silty clays of										
Fine-grained soils (More than half material is smaller than No. 200	Silts and clays (Liquid limit greater than 50)		Mŀ	1	Inorganic silts, mica- ceous or diatomaceous fine sandy or silty soils, elastic silts	Plasticity Index						"k"ling	OH an	d MH		
half mat half	Silts and clays	mit great	Cŀ	1	Inorganic clays of high plasticity, fat clays	20			CL							
(More thar			OH	1	Organic clays of medium to high plasticity, organic silts	10		CL-ML		ML a	hd OL					
		soils	Pt		Peat and other highly organic soils	00					Liquid	50 d Limit				0 100

<sup>&</sup>lt;sup>a</sup>Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits, suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater than 28.

<sup>b</sup> Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group sympols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

#### **GENERAL NOTES**

#### **SAMPLE IDENTIFICATION**

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DECCRIPATIVE WEDAY (0/ D)	UDDU IUCICIUS	DADRICLE CIZE (DIAMETER)
DESCRIPTIVE TERM (% B)	Y DRY WEIGHT)	PARTICLE SIZE (DIAMETER)

Trace: 1-10% Boulders: 8 inch and larger Little: 11-20% Cobbles: 3 inch to 8 inch Some: 21-35% Gravel: coarse - 3/4 to 3 inch And/Adjective 36-50%

fine – No. 4 (4.76 mm) to  $\frac{3}{4}$  inch

Sand: coarse - No. 4 (4.76 mm) to No. 10 (2.0 mm)

medium – No. 10 (2.0 mm) to No. 40 (0.42 mm) fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)

Silt: No. 200 (0.074 mm) and smaller (non-plastic) Clay: No 200 (0.074 mm) and smaller (plastic)

#### SOIL PROPERTY SYMBOLS

PID:

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance
-	(correlated to Unconfined Compressive Strength, tsf)

**DRILLING AND SAMPLING SYMBOLS** 

Split-Spoon Shelby Tube -3 inch O.D. (except where noted) ST: CS: 3 inch O.D. California Ring Sampler Dynamic Cone Penetrometer per ASTM DC:

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AU: Auger Sample Diamond Bit DB: Carbide Bit CB: Wash Sample WS: RB: Rock-Roller Bit Bulk Sample BS:

Depth intervals for sampling shown on Record of Note:

> Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-Units. (BDL=Below Detection Limit)

Penetration Resistance per 12 inch interval, or fraction thereof, for a standard 2 inch O.D. (1% inch I.D.) split spoon sampler driven N: with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N-Values where plus sign (+) is shown.

Penetration Resistance per 13/4 inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test Nc: N-Value in blows per foot.

Penetration Resistance per 12 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 Nr: inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

## SOIL STRENGTH CHARACTERISTICS

### COHESIVE (CLAYEY) SOILS

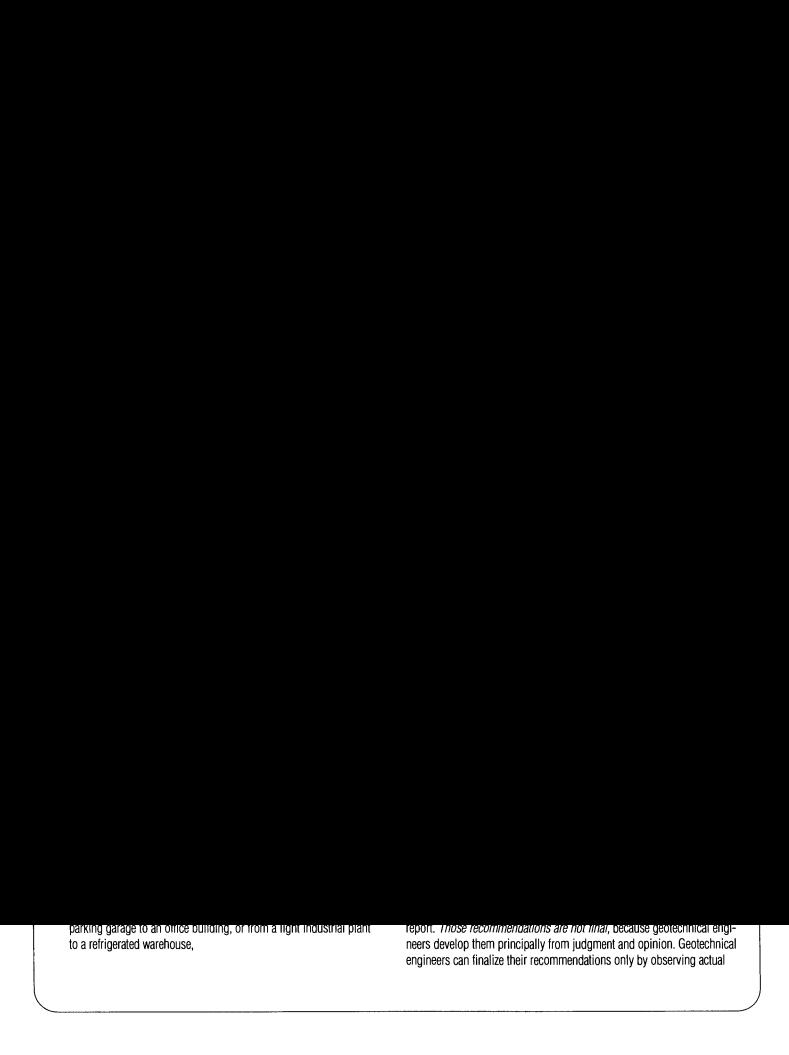
Results of vapor analysis conducted on representative

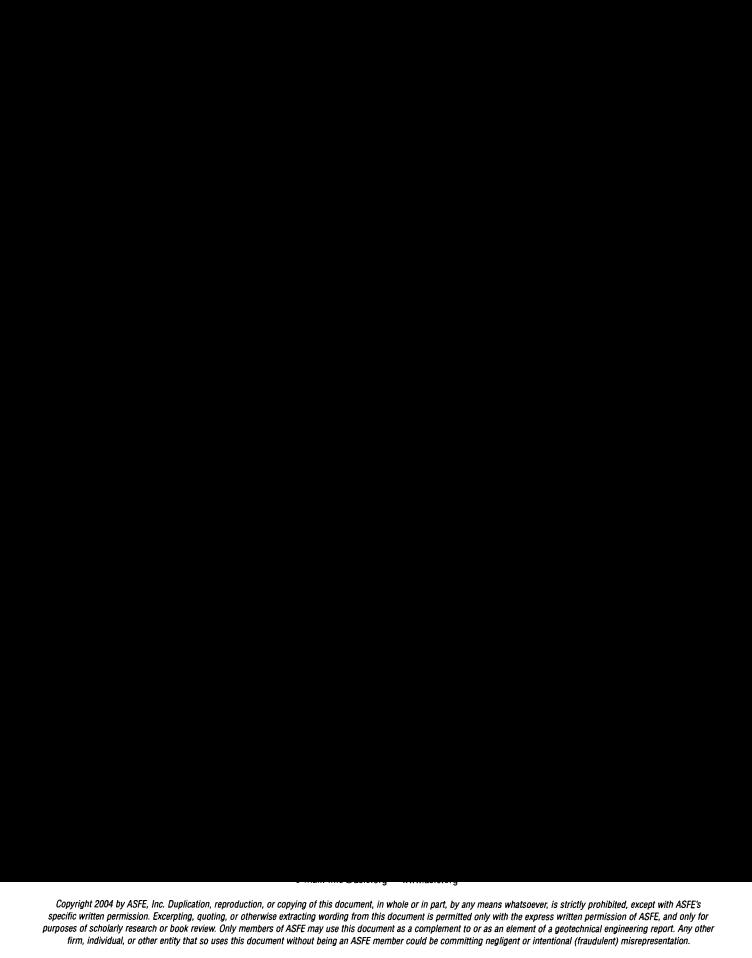
#### NON-COHESIVE (GRANULAR) SOILS

COMPARATIVE CONSISTENCY	BLOWS PER FOOT (N)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	RELATIVE DENSITY	BLOWS PER FOOT (N)
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	3 - 4	0.25 - 0.50	Loose	5 - 10
Medium Stiff	5 - 8	0.50 - 1.00	Firm	11 - 30
Stiff	9 - 15	1.00 - 2.00	Dense	31 - 50
Very Stiff	16 - 30	2.00 - 4.00	Very Dense	51+
Hard	31+	4.00+	•	

DEGREE OF PLASTICITY	ΡΙ	DEGREE OF EXPANSIVE POTENTIAL	ΡΙ
None to Slight	0 - 4	Low	0 - 15
Slight	5 - 10	Medium	15 - 25
Medium	11 - 30	High	25+
High to Very High	31+	-	









**ATLANTA, GA** (770) 458-3399

**DALLAS, TX** (214) 358-5885

LOS ANGELES, CA (714) 279-0817

MILWAUKEE, WI (262) 544-0118 ORLANDO, FL (407) 321-5356 TAMPA, FL (813) 283-0096 BALTIMORE/WASHINGTON, D.C. (410) 636-9320